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VIEWS, NEWS AND INTERVIEWS.

Mr. Andrew Carnegie is occupying, for the Winter, the handsome residence of Mr. E. H. Johnson, president of the Interior Conduit and Insulation Company, at Greenwich, Ct.

The Cosmopolitan Electric Company, of Chicago, has come to life again, and last week secured permission to lay conduits in the downtown district. If the company's plans are successfully carried out it will become a direct competitor of the Chicago Edison company.

The Appellate Division of the New York State Supreme Court has decided that a woman could not recover damages from the Western Union for the grief and anguish caused by the delay of a message which prevented her attending her brother's funeral. In his opinion Justice Barrett said: "There is, in fact, no congruity between pecuniary loss and isolated mental pain."

The directors of the Union Traction Company, of Philadelphia, have adopted the recommendation of the executive committee to call an installment of $2.50 per share on the stock, payable March 1. The company's books will close on February 10 and reopen on March 2.

The syndicate which has purchased the Long Island Railroad has engaged President Vreeland, of the Metropolitan Street Railway Company, of New York city, to make a physical examination of the Long Island property.

While two employés of the Metropolitan Street Railway Company, of New York city, were delivering bags of money to a Broadway bank one day last week, a smart thief came along and carried off a bag containing $5,600.

Omaha, Neb., has 95 miles of cable and electric street railway, the longest line being nine miles.

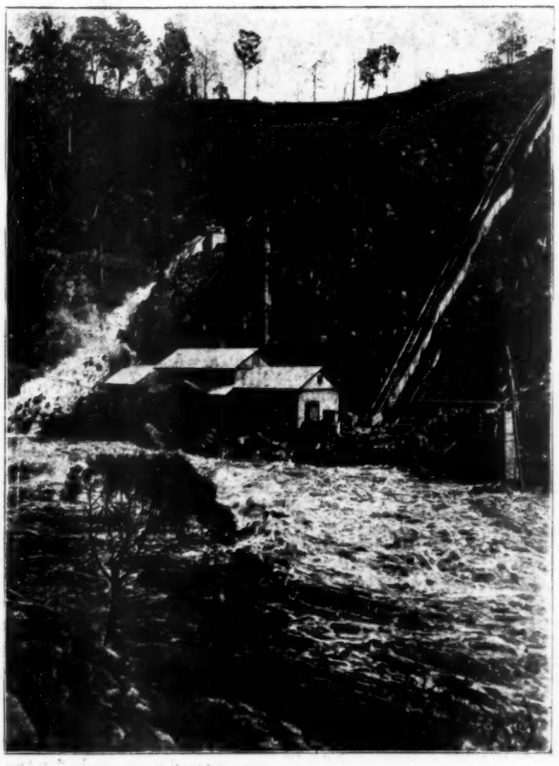
Electricity in Paterson, N. J.

The Edison Electric Illuminating Company of Paterson, N. J., believing that a better knowledge of the applications and simple laws governing the electric current would be of interest to their customers and further their business, their general manager, Mr. William Brock, has written a book for distribution in which he has given a concise and clear elementary statement of the A B C principles of the science. The explanations are ingeniously made by a practical man, and the stereotyped analogies are conspicuous by their absence, and the book is well illustrated. The ELECTRICAL REVIEW acknowledges the receipt of a copy.

ELECTRIC LIGHTING IN TASMANIA.

AN INTERESTING ELECTRICAL-WATER-POWER INSTALLATION.

Messrs. Siemens Brothers, the well known London electrical firm, have recently completed an interesting electrical-water-power installation, which is now furnishing current to Launceston, Tasmania. For the accompanying illustration and the following description of this interesting plant we are indebted to our London namesake: The site fixed for the generating station is three miles from the center of Launceston, but there is no road to the place. The building material was prepared at one side of the river and slung across on a wire rope tramway; the machinery, however, had to be taken round a distance of seven miles through the bush, but that only brought it to the top of a steep hill, about 500 feet in height, down which the whole of the plant had to be lowered.



ELECTRIC LIGHTING IN TASMANIA.—WATER-POWER PLANT WHICH FURNISHES CURRENT TO LAUNCESTON. THE PICTURE SHOWS THE RIVER IN FLOOD.

Ever since Launceston was first settled, the residents recognized that great power was available from the South Esk River, which rushes in a series of cataracts for miles above the gorge, where it joins its waters with those of the North Esk, to form the River Tamar. Driving machinery for flour-mill purposes was the only application of the enormous force offering itself until comparatively late years, when enterprising citizens, hearing of what was being done in other countries, began to talk of using the water power for the generation of electricity.

The City Surveyor, Mr. David, after considering various propositions, decided to tap the river at a certain point, already determined, by driving through a bend to a spot some 90 chains above first basin, which would give him sufficient fall. He found the plan quite practicable, and that it would be far superior to the pipe-track scheme, inasmuch as the tunnel, once made, would entail practically no maintenance cost, and would be free from the objection which those acquainted with the banks of the South Esk at the point concerned know to be a serious one; that interruptions, vexatious while they last and costly to set right, would be caused by rocks and trees falling onto the pipes. The cost of this scheme, including the necessary dams and other extraneous works, was estimated at £13,169. The dams and race were put in, under Mr. David's personal superintendence, by day labor, at a cost of £1,312. It was freely asserted that the tunnel could not be driven for double the estimated cost, that it would occupy three years in driving, etc., objectors basing their arguments upon the cost of driving in similar country elsewhere. Events proved the unreliability of the objectors' data, as the drive was put through in 16 months'

actual working time, driving from both ends; and when on March 28, 1895, the men working from the two ends met, the engineer had the satisfaction of finding that his levels had been less than an inch out. The actual cost of the tunnel proved to be £11,913, or with dams, etc., a total of £13,225, as against £13,169 estimated.

The grade of the tunnel is one in 110, calculated to give a velocity of about 10 feet per second, and therefore a discharge of about 11,780 cubic feet per minute; but as by Parliamentary restrictions only two-thirds of the water flowing in the river is to be made use of, that quantity, equal to 10,000 cubic feet per minute, is all that can be depended on during dry Summer weather.

The resulting horse-power, taking 10,000 cubic feet per minute as a basis, is 1,562, at 75 per cent efficiency of turbine, and costs, therefore, £8 10*s.* per horse-power, a rate which compares very favorably with similar work in any part of the world.

From a screening chamber the water, after being strained, is conveyed to the power-station by a pipe-line. The pipe is of wrought-iron, with flanged joints, is one-quarter-inch thick, and for the first 82 feet is five feet in diameter, the remaining 121 feet being four feet in diameter. The lower end is expanded into a bell mouth, six feet by two feet six inches. The bell mouth carries the water to a wrought-iron receiver 88 feet long, which extends along the back of the power-house. The central portion, 41 feet in length, is six feet in diameter, and is of wrought-iron three-eighths-inch thick; the two end portions being three feet in diameter and one-quarter-inch thick, all being held back by one and one-half-inch anchor bars. The receiver is fitted with four four-inch dead-weight safety valves.

From the six-feet section the water is led into the building by means of four two-feet four-inch pipes, and from the three-feet sections by six 12-inch pipes, though only three of the former and five of the latter are at present in use, one of each being left for future extensions. The water from these pipes is taken directly to the turbines, draft tubes being made use of to insure at least 110 feet of working head.

The generating station is situated above highest known flood mark on the river bank. It is built of the local basalt on concrete foundations, and with galvanized iron roof; is 105 feet by 24 feet in the clear, with a central bay of 40 feet, which is six feet wider. The height of the wings is 15 feet, and of the center 22 feet; to the wall plate in each case. The tail-race extends nearly the entire length of the building, is nine feet wide and 12 feet deep, and was excavated in the solid basalt. It is arched over with concrete, on which are bedded the girders to which the turbines and other machinery are bolted. The building, including foundations, cost £1,838.

The bid of Messrs. Siemens Brothers for the electrical plant, including maintenance for six months, was £32,000. The contractors arranged with Mr. Dunk, of Sydney, owner of a patent pole-trimming machine, to bring one of his machines to Launceston and trim all the poles to the form decided upon by the superintending engineer. The specification contemplated trimming the poles by manual labor, but the contractors were desirous to make them look well, and as only by the use of the machine could they be given that smooth and finished appearance which has been so admired in Launceston, the extra expense was not minded. After being trimmed to shape, octagonal from the ground line to eight feet above that line, and circular thence to the top with proper taper, the poles were mortised and the arms fitted into them, then a coat of paint given, and they were carted away to the site of their permanent position.

The machinery fitted only takes up about 400 out of the 1,560 horse-power available, the water running through the tunnel supplies; so that water is available without extra cost to drive nearly four times as much machinery as has been arranged for at the start. The water pipes from tunnel and the building are arranged to accommodate about 50 per cent more effective alternating plant and 25 per cent more arc-lighting plant. There are eight Thomson Vortex turbines at work, fitted with the Murray hydraulic governor. They are adapted for a fall of 110 feet, and arranged for coupling direct to the dynamos. Five of the turbines drive arc-light dynamos at 800 revolutions a minute, at which speed they each give 21 horse-power. The other three drive alternators at 460 revolutions a minute, and each gives 158 horse-power.

The arc-light dynamos are of Siemens Brothers' manufacture, and give a constant current of seven amperes and an electro-motive force of 1,750 volts when running at 800 revolutions a minute. The armatures are of the ring type and wire wound. The electro-magnets are of the double magnetic circuit type, made of the very best wrought-iron, and are series wound. They are driven direct by the turbines. In Launceston there are in use 120 Siemens "band" arc lamps, taking seven amperes, and burning for 16 hours without retrimming.

LITERARY.

McClure's Magazine for February will contain some Kansas stories by William Allen White, the young editor of the Emporia *Gazette*, whose recent editorial, "What's the Matter with Kansas?" attracted so much attention.

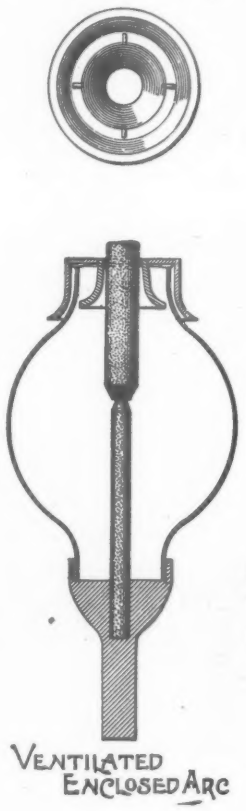
City Government is the title of a new monthly publication, of handsome typographical appearance, devoted to the practical affairs of municipalities. It covers a new field, and has received the indorsement of many prominent city officials. The paper is published by the City Government Publishing Company, 150 Nassau street, New York city. Mr. Clarence E. Stump, formerly well known in electrical journalism, is the president and treasurer of the company.

THE INCLOSED ARC LIGHT.

DELIVERED BEFORE THE SOCIETÉ INTERNATIONALE DES ELECTRICIANS, PARIS, FRANCE, JANUARY 20, 1897, BY L. B. MARKS, M. M. E., OF NEW YORK CITY.

The unprecedented industrial utilization of the inclosed arc light in America during the past two years has aroused the attention, not only of American electricians and engineers, but of scientists the world over. Although some of the earlier inventors in this field achieved a modicum of temporary success, every attempt to introduce the inclosed arc lamp commercially eventually met with decided failure.

Before going into the details of the



subject, or presenting a sketch of the art of inclosed arc lighting, it may not be amiss to point out the characteristic distinction between the ordinary arc and the inclosed arc. The ordinary arc, commonly known as the open arc, is generally inclosed in a globe more or less tight at the top and bottom. This is also the case with the inclosed arc. In the former, however, the arc depends for its efficient operation upon an excess of air or oxygen-bearing gas, while in the latter provision is made for the partial or total exclusion of the atmosphere. With this preface, I shall now revert for a few moments to the earlier forms of inclosed arc lamps.

HISTORICAL SKETCH.

The history of the art may be said to date back to 1846, when Mr. Wm. E. Staite first produced an inclosed lamp in which one carbon was supported on a rod passing through an air-tight bushing into a globe, and the other carbon mounted in a tube projecting through the base of the globe and fed by a rack operated by clockwork. In this lamp the arc was struck by pushing the carbons apart by hand. At that early date Staite pointed out that "the more rarefied or deoxygenated the air around the point of ignition is, the more continuous and brilliant the light; hence may be deduced the propriety of inclosing the electrodes in a vessel of small dimensions, hermetically sealed from the external atmosphere, but with a valve in it for the escape of the included air when the expansion begins to exceed those limits which experience may show to be compatible with the safety of the apparatus."

About a year later Staite improved this lamp in various details. Instead of springing the arc by hand it was done automatically by an electro-magnet. The arc was inclosed in an air-tight globe and the regulation effected by electro-mechanical means.

After Staite's experiment there followed a period of inactivity in this line, and it was not until the 70's that the work was again zealously taken up. In 1878 F. H. Varley brought out a lamp containing an air-tight chamber in which carbon powder was allowed to fall from one electrode to another, as from an hour-glass, the carbon being heated to incandescence in transit. The mechanism of the lamp was so arranged that the carbon, after falling through the arc space and becoming incandescent, was again returned by suitable carriers to go through the same operation. In 1879 George G. André devised an electric lamp in which the carbons were inclosed air-tight in a large globe, no provision having been made for egress or ingress of gases. The oxygen of air in the globe gradually combined with the volatilized carbon, when the lamp was in operation, until finally the electrodes burned in an atmosphere consisting largely of carbon gas.

About this time there was considerable activity in the production of inclosed arcs of a different type; viz., the semi-incandescent arcs. In this form the carbons or other electrodes, as the case may be, are in imperfect contact, the point of juncture being heated to a state of incandescence when the current is passed. Such was the lamp of Brougham, in which the carbons were inclosed in a receptacle from which the atmosphere was excluded; no arc was sprung in this lamp, the light emanating from the incandescent points. Following closely on this, in the year 1880, André and Easton produced a lamp similar to the older type already described, but differing from the latter in that the movable carbon was maintained in contact with the negative in a closed chamber, and was fed upward as the carbons burned away, the feed being effected by a weight released by a magnet acting on a friction disk. The same type of lamp is also described by Hedges, who substituted a metal disk for the negative carbon, the positive carbon feeding and continuously bearing against this metal disk, and heating the joint to incandescence.

The well known lamp of Werdermann, which was brought out in 1882, is another type of the typical

incandescent arc. In Werdermann's lamp the carbons were inclosed in an air-tight globe. A thin carbon pencil was propelled against a large negative electrode by a spring; the pencil passed through a block of magnesium or other refractory substance, and a considerable length of the electrode between the block and the contact was rendered incandescent. After the lamp was started the oxygen contained in the globe quickly combined with the carbon, the residual gases thus consisting of nitrogen and carbonic oxides. Among other lamps of the same type, in which no true arc was sprung, were the earlier forms of Jansen in 1875 and Scott in 1878, and subsequently those of Rapieff, Nordenfeldt, Pilleux and Quesnot.

The record of development between 1880 and 1884 shows that a number of lamps of the inclosed type, in which a true arc was sprung, were produced. The principal ones were that of Varley, in which the arc was inclosed in a glass globe or shade filled with carbonic anhydride, or hydrogen, or dried nitrogen; those of Wallace, Brewer and Menges; that of Beardslee, in which the arc was inclosed in a small globe, air-tight at the bottom and having a contracted neck at the top through which the movable carbon passed; that of Baxter, in which the entire lamp mechanism was inclosed air-tight, provision for the egress of heated gases under pressure being made by suitable valves connecting the inclosure with the outer air; and that of Short, similar to the last. Besides these there were several others, differing from those cited only in detail.

THE INCLOSED ARC IN AMERICA.

In America the first attempts to utilize the inclosed arc in commerce date back to the early eighties, when Beardslee produced an inclosed arc and William Baxter experimented with long-hour inclosed lamps. Baxter's experiments and tests covered a period of years, but resulted in failure. From time to time other inventors took up the subject, but as the ground covered by them differs very little from that of earlier efforts, it will not be necessary to dilate here upon the various schemes attempted since the original presentation of the Beardslee and Baxter lamps, respectively. This brings us to the time when Howard took up this line of work in conjunction with me about five years ago. Most of you are familiar with the tests reported by me at the International Electrical Congress, at Chicago, in August, 1893. This paper was hastily prepared to present a subject which, in the opinion of those who had witnessed the trials, was deemed worthy of the fullest description possible at the time. The arrangement of parts disclosed in the lamp referred to in the paper at Chicago was rather unique in some details, but in principle did not differ essentially from earlier forms. It was thought at that time that the inclosed arc would have a large field on constant-current circuits, and an attempt was made to equip existing lamps with the inclosing device. This device, which was very crude, consisted of a cylindrical glass receptacle clamped by disks, which pressed tightly against its upper and lower edges, respectively, the lower end being closed air-tight and the upper end provided with an opening through which the positive carbon passed. In this equipment the negative electrode was made of metal. I shall have occasion to allude to this metal negative later on; also to point out the prime cause of failure in this, as well as in many of the other forms of inclosed arc herein referred to. Subsequently, another device was used, which consisted simply of a small bulb, fitted practically air-tight at the bottom and closed on top by a valved cap through which the upper carbon fed. This appurtenance could be attached to any arc lamp. The negative electrode was in this case made of carbon. A circuit of lamps of this type was tested in the Winter of 1893 and early part of 1894, at Buffalo, N. Y. The report and discussion of tests were published in the electrical journals of the time; also in the transactions of the National Electric Light Association, Washington, D. C., convention, 1894.

We come now to the ventilated inclosed arc, which was devised by me a few years ago and described in some of your technical journals. You will note from the cut presented herewith that the inclosure is provided with means for directing the path of the ingress of air and the egress of gas. You observe that the bulb is pressed tightly against a practically air-tight bottom and is closed at the upper end by a bell-shaped cap or plug, wherein resides the novelty of the equipment. This plug is made of metal and is shaped so that the rim is brought closely adjacent to the exterior wall of the envelope, thus providing a narrow annular passage for the outside air into the envelope, by means of which the entering air is highly heated in transit before reaching the interior of the bulb. You will also see that the tubular opening through which the upper carbon feeds is conical in shape, the opening at the top being only a little greater than the diameter of the electrode, so as to permit a free feed of the latter and afford an obstructed egress for the gases from the envelope. As the closure touches the glass only at four points, shown in the drawing, the tendency of this arrangement is for all egress to take place by way of the central tubular opening, and of ingress by way of the bell-shaped chamber. In other words, the convection currents naturally formed by the heat of the arc are taken advantage of to secure a steady and uniform circulation of oxygen bearing gas in the inclosure. By the use of this equipment the life of the electrodes was prolonged three or four times, the lamps being operated on a constant-current circuit under practically the same conditions as to current and voltage as the open arcs. In practice it was found that the ventilated inclosed arc had many shortcomings, and could rarely be operated under favorable conditions on commercial circuits.

(To be continued.)

The First Radiograph Showing Arterial Circulation, Made in Hudson Street Hospital, New York.

Superintendent Herman A. Knoll and Dr. Philip E. Johnson, both of the Hudson Street Hospital, New York, have recently accomplished important advances in the use of X rays in connection with surgery,

RADIOGRAPH SHOWING BRACHIAL ARTERY WITH LIME DEPOSITS IN BLOOD.

inasmuch as they have been able to make a negative showing clearly defined the arterial circulation of the forearm. Up to this time, we believe, the control of the X rays has not permitted the showing or indication of the blood circulation.

The illustration shown herewith is made directly from a print of the negative. In the half-tone processes it is not possible to retain the same delicacy and accuracy of shadows or tones that appear in the print of the negative, and in this reproduction the very slightest touch of the engraver's brush has been given to the arteries to make it equal in strength to the negative print, but it is in no degree an exaggeration of the photograph kindly furnished the ELECTRICAL REVIEW by Superintendent Knoll.

The engraving shows the brachial artery and its bifurcation at or near the elbow into the radial and ulnar arteries.

The exposure, Superintendent Knoll stated, was less than one minute—about 50 seconds—and the apparatus used was that known as the "Edison."

The theory has been advanced that the subject from which this radiograph was made might have had an unusual supply of lime salts in the blood, and in this case it might have had the effect of bringing out in greater relief the arteries when the picture was made.

TELEPHONE NEWS AND COMMENT.

The reported gross earnings for the year of the Chicago Telephone Company were $1,955,829; net, $600,265, or 13.84 per cent on the stock.

The American Electric Telephone Company, of Kokomo, Indiana, has now over 300 exchanges and 50,000 telephones in operation in all parts of the United States.

The Erie Telegraph and Telephone Company made a net gain of 273 subscribers in December, and 2,798 for the year 1896. Total number connected January 1, 21,389.

The annual report of the Central Union Telephone Company shows that the gross earnings for the year were $1,327,931; expenses, $1,026,311; net earnings after interest charges, $237,099.

A bill was introduced in the New York State Assembly on January 19 regulating telephone charges, so that New York is to pay $85 rental per annum and Brooklyn $75, with proportionate reduction in case of cities with smaller populations.

A plan for a citizens' telephone company is being discussed in Albany. It is estimated that a contribution of $25 each from 500 subscribers would pay for a complete equipment, and that the annual cost of maintenance and operation would not exceed $5 for each telephone.

The Southwestern Telegraph and Telephone Company, of New York city, on January 22 filed with the Secretary of State a certificate of increase of capital stock from $3,000,000 to $4,000,000. The company has a paid-in capital of $3,000,000, and debts and liabilities of $225,000.

At the annual election of the Superior–Duluth, Minn., Telephone Company the following officers were elected: President, A. G. Fuller; vice-president and treasurer, A. W. Taussig; secretary, C. H. Graves; manager, Edward Lomasney. The old directors were all re-elected.

The Sandy River, Me., Telegraph Company, at its annual meeting, elected the following directors: A. M. Greenwood, F. E. Timberlake, Phillips; Chester Greenwood, Farmington; P. H. Stubbs, Strong; W. H. Cook, Farmington. The directors organized and chose A. M. Greenwood, president; F. W. Butler, Farmington, clerk and treasurer.

A Big Electrical Year.

[*From the Philadelphia Press*]

There has recently been more interest in electrical stocks not only in New York, but in this and the Boston markets. No industry in the country has such good prospects for business and immediate profits. All the leading concerns have orders ahead, and the prospect is for a big year.

Electric Railways.

The United States District Court has appointed G. Herbert Condit receiver of the Englewood & Chicago Electric Street Railway. The proceedings were taken at the instigation of the New York bondholders, and is believed to be part of a plan to reorganize the company and finish the road.

The Buffalo & Williamsville, N. Y., Electric Railway Company's statement for quarter ending December 31 shows gross earnings from operation to be $2,769.61 and the operating expenses to be $1,837.22. Income from other sources, $28.25, making a net income from all sources of $960.64.

A company calling itself the East Pennsylvania Traction Company has asked the New Hope, Pa., Borough Council for permission to enter that burg with a trolley road. It is said the company has already secured the right of way from Doylestown to the borough line, coming up the old York road pike.

H. W. Wright & Company, of Springfield, Mass., formerly the Springfield Electrical Equipment Company, have attached the property of the Shelburne Falls & Colrain Electric Railroad, which was opened a few weeks ago, for $40,000, and will commence a suit in Hampden County against the corporation.

The Rapid Transit Railway Company, of Syracuse, N. Y., has elaborate plans for equipping its road. A new power-house will be built, heavy rails will be laid on all of the lines that are not equipped with them now, and some of the lines will be extended. When the power-house is completed all the lines in the city will be operated from it.

The annual report of the Rochester, N. Y., Railway Company shows the following: Gross earnings from operation, $70,999.51; operating expenses, $42,626.20; net earnings from operation, $28,373.31; income from other sources, $710.22; gross income from all sources, $29,083.52; interest on funded debt and taxes, $26,193.03; net divisible income, $2,890.50.

The reorganized company of the Northeast Electric Railway, of Kansas City, Mo., filed a formal deed of trust in the Recorder's office to secure the payment of $250,000 worth of bonds issued for improvement of the road to the Trust Company of North America and Edmund G. Vaughn as trustee for the bondholders. The deed includes all the property of the new company.

At a meeting of the stockholders of the Newark, Ohio & Granville Consolidated Railroad Company the following directors were elected: Messrs. W. E. Miller, C. W. Miller, J. A. Flory, W. C. Christian, Herbert Atherton, John Schlegel, Henry Schiedler, Rhinehart Schiedler, F. A. Crane. The board of directors then organized by electing the following officers: President, W. E. Miller; secretary, C. W. Miller; treasurer, John Schlegel.

The Ottawa, Ill., Electric Street Railroad, which has been abandoned about a year, has been purchased by Boston and local capitalists, and will be again operated. The plant has been purchased from the General Electric Company. The capital stock is $100,000. The directors are W. F. Ellis and H. M. Oliver, of Boston; G. J. Paul, of Chicago; ex-Attorney-General Moloney and ex-Mayor Schoch, of Ottawa. It is expected in time to extend the line to Marseilles, Buffalo Rock, Utica, La Salle and Peru.

The following is an abstract of the report of the Westchester, N. Y., Electric Company for the December 31, 1896, quarter: Earnings, $29,234; expenses, $21,274; net, $7,960; charges, $7,302; surplus, $658. Assets of $1,032,611 include $962,085, cost of road and equipment; $47,545, due by companies, etc.; $15,601, cash on hand; $7,078, profit and loss (deficiency). Liabilities: Capital, $500,000; funded debt, $500,000; loans and bills payable, $12,500; interest on funded debt due and accrued, $12,500; due for wages and supplies, $7,611.

At the annual meeting of the Akron, Bedford & Cleveland and the Cleveland & Lorain Electric Railroad companies the following officers were elected: H. A. Everett, president; W. M. Christy, vice-president; E. W. Moore, treasurer; F. S. Borton, secretary. The directors are H. A. Everett, Will Christy, E. W. Moore, James Christy, Jr., I. N. Topliff. For the Lorain company the directors are B. Mahler, C. H. Stewart, E. G. Tillotson, S. H. Short, Joseph B. Hoge, W. J. Garone and E. W. Moore. The officers are B. Mahler, president; E. G. Tillotson, vice-president; E. W. Moore, treasurer; Joseph B. Hoge, secretary; F. W. Coen, assistant secretary.

The projectors of the electric railway from Seneca Falls, N. Y., to Auburn have already completed plans for the construction of an iron bridge across Cayuga Lake, running directly from the Bayard street road to Cayuga. The plans approved contemplate gradually raising the grade on the bridge, beginning near the eastern shore, so that the cars will run over the Central tracks and at the same time lessen the steepness of the grade necessary to reach the top of the hill on the Auburn road east of Cayuga. It is stated that work will be commenced early in the Spring. N. H. Becker and W. C. Gray, of Cayuga, are interested in the enterprise with other business men and capitalists of Auburn, Syracuse and Chester, Pa. The capital stock of the company is $500,000.

ELECTRIC LIGHT FLASHES.

A new company has been formed in San Francisco, Cal., called the San Francisco Gas and Electric Company, with a capital of $20,000,000. This is the result of consolidation of the Edison Light and Power and San Francisco Gas Light Company.

C. Hamlin, former lineman of the Cortland, N. Y., & Home Electric Light Company, is about to apply to the trustees of Cortland and Home for a franchise to establish a rival electric light company. He proposes to furnish 75 lights to Cortland for $6,000.

The purchaser of the electric plant at Bedford City, Va., Mr. John D. Langhorn, of Washington, has organized a stock company, of which Mr. J. A. Clark has been elected president and Mr. Allan Cuculler, secretary. Messrs. J. M. Claytor, O. B. Smith and W. B. Dunn compose the board of directors.

At the annual election of trustees of the State Electric Light and Power Company, of New York, the following directors were elected for the ensuing year: Noah L. Cocheu, Lewis R. Stegman, James Niblo, Frank A. Wunder, Charles Gorman. The inspectors elected were John A. Braman, J. Warren Tway, Philip F. Lenhart.

At the annual meeting of the stockholders of the Chester, N. J., Electric Light and Power Company the following officers were elected: H. B. Black, president, and the board of directors chosen included John McGolrick, John R. Sweeney, Joseph Deering, G. P. Dennis, Joseph Messick, J. George Kaelber, I. E. Cochran, Jr., J. Albert Will, George C. Hetzel.

The stockholders of the Columbus, Ohio, Edison Electric Light Company, at their annual meeting, elected the following officers for the ensuing year: C. H. Lindenberg, Adolf Theobald, John Siebert, J. R. Lovejoy, Emil Kiesewetter, J. F. Martin, F. E. Drake, Louis Siebert and A. W. Field, directors; president, Adolf Theobald; vice-president, J. F. Martin; treasurer, Emil Kiesewetter; secretary and general manager, A. W. Field.

Electric Lighting in Dallas, Tex.

At a meeting of the City Council of Dallas, Texas, held on January 12, the following resolutions were passed:

Whereas, The contract for lighting the city, now held by the Dallas Electric Company, expires November 3, this year; and, Whereas, Considerable time is necessary to investigate matters connected with same looking to the betterment and cheapening of said lighting system, Therefore, be it

Resolved, That the light committee, in connection with the city electrician, investigate and report to this council at as early a date as possible what, in their opinion, would be the most economical and satisfactory course to pursue, and what system of lighting would be the most satisfactory and cheapest for the city to use. Be it further

Resolved, That said committee and electrician investigate the surplus boiler capacity now at Turtle Creek pump-house, and bring in an estimate on the necessary machinery and construction material for 300 arc lights.

PROTECTIVE DEVICES FOR TRANSFORMERS.

BY HERBERT C. WIRT BEFORE THE NORTHWESTERN ELECTRICAL ASSOCIATION, JANUARY 20, 1897.

The transformer itself is a protective device, as it was introduced to permit the operation of incandescent lamps from high-voltage circuits with safety to human life. It has so well accomplished this purpose that there are in operation in the United States 4,000,000 16-candle-power lamps, which are supplied with energy by means of transformers.

A large number of transformers were introduced 10 years ago, at a time when experience with electrical machinery for operation on high-voltage circuits was limited, and therefore many transformers were not properly constructed, and the failure of insulation may be laid, in part, to faulty design.

The object of this paper is to call attention to several protective devices which have been designed to render the transformer absolutely safe, and to suggest some precautionary measures that should be used by managers of central stations.

The cases which have occurred where the primary current has passed to the secondary wiring are comparatively few, but still sufficiently numerous to warrant the taking of greater precaution to prevent the possibility of fatal accidents.

This subject is receiving careful attention on the part of the underwriters, and many central station managers are looking into the question. Very little information has been published on this subject. Mr. William H. Merrill, Jr., electrician of the National Board of Fire Underwriters, has issued very valuable and interesting reports relating to fires of electrical origin, and during the past three years 62 cases have been mentioned by him where the primary current has passed to the secondary wiring, and which have been considered only as a fire hazard.

The following cases have been investigated, and may be of general interest:

"Fire No. 867. Converter burnout. About 60 converters connected by aerial wire burned out by lightning."

Investigation showed that these burn-outs occurred in *transformers not insulated with oil.* The primary voltage was 2,750. The line was not protected by line arresters, but was protected by station arresters. The secondary wires were run in a damp building and were quite likely grounded, thus affording an easy path for the primary current to reach ground through secondary wiring, and across the insulation in the transformer.

"Fire No. 1,000. Converter burnout. Primary current on secondary circuit. Current grounded through soft-rubber insulating joints on combination fixtures. Rubber burned out and escaping gas ignited. Discovery prompt. Electricity and gas

turned off, preventing serious damage."

"Fire No. 1,001. Similar to 1,000. Small loss."

These burn-outs occurred in *transformers not insulated with oil*, and which were connected to a 1,000-volt circuit. Lightning arresters were installed at station and on lines. These burn outs did not occur during a storm.

"Fire No. 1,370. Converter burnout. Primary current on secondary circuit. High-tension current grounded through secondary wiring to a gas-pipe placed near a single-pole switch. Gas-pipe was scarred by the arc, the switch and connecting wires were fused, and the interior decorations at the point were damaged. Loss, about $300.

Transformer was connected to a 2,000-volt circuit, *was run without oil*, and was not protected by line or station lightning arresters. The burn-out occurred during a lightning storm. There was no evidence of a leak between primary and secondary previous to the storm. The transformer was of modern type, and was first used May 27, 1895.

"Fire No. 1,445. Converter burnout. Primary current on secondary circuit. Current grounded through rubber insulating joints of fixtures burning out rubber, allowing gas to escape, and ignited the gas. Part of the side wall and ceiling of the dwelling burned, together with partial destruction of carpet and some fixtures. Prompt discovery of the fire by a patrolman passing the building prevented serious loss, as the occupants were away at the time. Loss, $150."

This burn-out occurred during a lightning storm. Arresters were installed at station and on lines. In this transformer, which was manufactured in 1888, *oil was not used*. Primary voltage, 1,000.

"Fire No. 1,446. Converter burnout. Similar to No. 1,445. Part of ceiling and joists of dwelling-house burned. The occupants managed to shut off the gas at the meter immediately the fire was discovered. The case of this transformer had originally been grounded, but the ground wire had been cut subsequently. Loss, $50."

Transformer was connected to 1,000-volt primary; was protected with arresters, *and no oil was used*.

You will note in every case the electrical discharge ignited the gas. It is easy to see the cause of this. The current passes from the secondary wires to the fixture, and then across the insulation in joint to the gas-pipe system and to earth, forming an arc at the insulated joint, thus setting fire to the gas. If, however, insulated joints were not used, the path to earth from the secondary wires would be made easier, and probably a greater number of breakdowns would occur.

Note all these accidents occurred in *transformers that were not insulated with oil*. Note also that many of these breakdowns occurred during a lightning storm, proving conclusively that most transformers are burned out, not by the alternator current, but by electrical discharges, due to disturbances of the atmosphere. It is, therefore, necessary to have a transformer insulated to stand such discharges, rather than to stand the alternator potential.

In the early days of transformer construction the insulation was not designed to stand any definite voltage in excess of the alternator voltage. A transformer was supposed to be properly made if it did not burn out when tested on the standard current for which it was designed. Transformers of early design will just stand a high-potential test of 3,000 volts.

The majority of transformers manufactured during the past year are made to stand a test of 5,000 volts between primary and secondary windings. One manufacturer has brought up the standard of insulation on his transformer sufficiently to stand a 10,000-volt alternating-current test between primary and secondary.

The insulation of transformers should always be measured by high-potential current, rather than by an insulation resistance test, in which a moderate voltage is used. Even 500 volts is not sufficient to properly test transformers, for it is easily seen that a small gap or break in insulation may be great enough not to be bridged by a 500-volt current, but the normal alternator potential of 1,000 or 2,000 volts will immediately start an arc across the defective insulation.

Oil should always be used to insulate transformer windings, as a high-potential current will jump a space in air five times as great as in oil. The oil keeps the air from the coils, and prevents oxidation of the insulation material. The air in a transformer not insulated with oil is heated and expanded from the coils, and when the transformer is cooled, air containing moisture can be drawn into the coils.

A number of automatic devices have been designed to be connected to the secondary wiring of transformers, so that in event of the high-tension primary current passing to the secondary wiring, it will be automatically connected to the earth, thus preventing any danger of a shock, or the possibility of causing a fire.

The most prominent devices are those designed by Prof. Elihu Thomson, in this country, and by Major Cardew, electrical adviser of the Board of Trade in England.

The Cardew earthing device consists of two metal plates, separated and insulated from each other by one-quarter-inch air space. The plates are held in a horizontal position. A thin strip of aluminum foil, about three inches long and one-quarter-inch wide, is flexibly attached at one end to the upper plate, which is connected to the secondary wiring, and the other end is supported near to, but normally not in contact with, the lower plate, which is connected to a good ground. If a difference of potential of 300 volts exists between these two plates, the aluminum foil is attracted to the lower plate and will remain in contact with it until the primary fuses are blown. This, therefore, automatically grounds the secondary whenever there is a difference of more than 300 volts potential between secondary wires and earth.

Several thousand of these devices are in use in England, as such apparatus is required by the following regulation of the English Board of Trade:

"In every case where a high-pressure supply is transformed, for the purpose of supply, to one or more consumers, some suitable automatic and quick-acting means shall be provided to protect the consumer's wires from any accidental contact with or leakage from the high-pressure system, either within or without the transforming apparatus."

On the three-wire system the device is connected to the neutral wire. With small transformers it is connected to only one side of the secondary circuit, and with large transformers one is placed on each secondary of wire.

It should be mentioned that most of the primary wires are run under ground in England, and the transformers are not, therefore, subjected to atmospheric discharges of electricity.

Prof. Elihu Thomson has invented several protective devices. The film cut-out, so called, is quite similar in its action to the Cardew earthing device, the only difference between the two being that the plates are separated by a thin film of paper, which is pierced by a potential of 300 volts, making a good connection, and thus permitting the primary fuse to melt. The device was first commercially used in 1890. The transformers at that date were so poorly insulated that it was found that the primary current passed to the secondary wiring so frequently their use had to be abandoned.

(To be continued.)

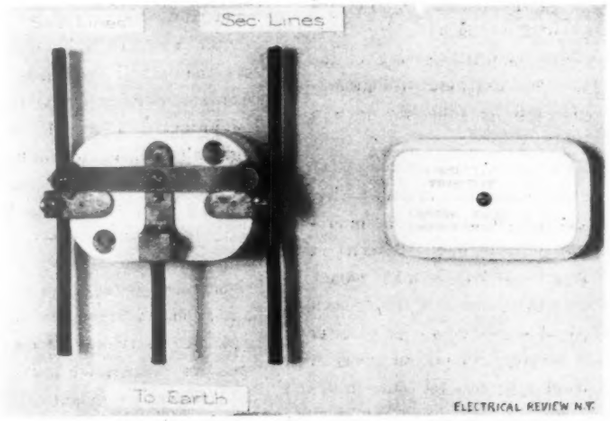


FIG. 1.—"PROTECTIVE DEVICES FOR TRANSFORMERS."—THOMSON'S PROTECTIVE DEVICE FOR TRANSFORMERS.

FIG. 2.—CARDEW EARTHING DEVICE.

Electric Light Stations and Gas Engines.

There has been constructed at Leyton, England, an electric lighting station driven by gas engines, upon the plans of Prof. Henry Robinson. The gas engines are supplied with semi-water gas made from anthracite in Dowson gas producers. The details of the installation are worth recapitulation as suggestive of what may be accomplished with this type of station. The producer house contains two producers, each capable of supplying all the gas expected to be required at the outset; and there is room for a third. Two small vertical boilers are provided to generate steam for the forced draught jets of the producers, each boiler being capable of serving the two producers. The gas is washed and scrubbed with coke and sawdust, and there is a holder, 20 feet by 10 feet, to equalize the gas production as well as to provide storage for running the engine for a short period. The town's gas is laid onto the engines in case the Dowson gas should fall off in quality with a light load. The engines (two in number to start with) are of 55 horse-power nominal. The gas passes from the holder in nine-inch cast-iron mains, with five-inch branches to the engines. The air supply to each engine is drawn through a five-inch pipe, through a silencing box outside the engine-house. The exhaust passes through a six-inch pipe into a 12-inch main, which discharges into an underground silencing box filled with stones and having a vertical outlet pipe 12 inches in diameter extending above the engine-house roof, with an arrangement of baffle plates at the top. The gas-producer house is 46 feet long and 18 feet wide, and the engine-house is 60 feet long and 37 feet 6 inches wide. A test of the gas-producing and power plant was made on October 6, and though full load was not put on, the consumption of fuel compared favorably with the performances of steam plant using the most efficient boilers and high-pressure compound condensing engines of large power.

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Special Notice to Advertisers.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

NEW YORK, JAN. 27, 1897.

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A lucky American manufacturer has received, or will soon receive, an export order for 1,000,000 electric-light carbons, purchased through a New York house. The competition was keen—export business is cash.

THE ACCIDENT ADJUSTER.

A large majority of the electric railway companies throughout the United States, especially those in the principal cities, have had more or less to do with the professional adjuster of damage claims against the companies. The professional adjuster frequently walks the streets during rush hours, keeping his eyes open for accidents. More often he reads the papers, and when he learns that a trolley accident has occurred, he hurries at once to the person injured and arranges with him to take charge of his case. He requires his "client" to enter into a contract with him under the terms of which the adjuster is to advance what money is required for the "client's" maintenance, pending a settlement of the case, either by suit against the company or by a compromise. The "client," on his part, agrees to return the money advanced, to turn over to the adjuster a large percentage of the money recovered, and not to talk with any agent of the company, but to trust his affair entirely to the adjuster. That his officiousness is annoying to the railway companies goes without saying. He is not always a lawyer, and sometimes gets himself in a tight place.

A recent occurrence in Jersey City, N. J., makes the attitude of the professional adjuster one of interest at the present time. A man named Werder was injured in a trolley accident about a year ago. An adjuster named Stanford, who is not a lawyer, got Werder to put the case in his hands and to sign a contract with him. The money advanced to Werder by Stanford amounted to $189.50. Werder violated his contract with Stanford and accepted a settlement from the company without Stanford's knowledge or consent. Stanford then brought suit in Judge Bedle's court to recover the $189.50 he had advanced. The adjuster was non-suited under an old law which of late years has not been often quoted and which may be of interest to the electric railway field in general.

Werder's defense was that the contract with Stanford was void because it was "barratrous, champertous, for maintenance, and against public policy." In rendering his decision, Judge Bedle said:

"I am satisfied that the case falls within the class of cases which, under the ancient English statutes, was held to be void for champerty, and also for maintenance, and that the bargain itself falls within the line of agreements which constitute barratry."

The Century Dictionary defines "barratry" and "champerty" as follows:

BARRATRY—In old Scots law, the taking of bribes by a judge. The fraud or offense committed by a barrator. A vexatious and persistent inciting of others to lawsuits and litigation; a stirring up and maintaining of controversies and litigation. This is a criminal offense at common law.

CHAMPERTY—A species of maintenance, being a bargain which a person not otherwise interested makes with a plaintiff or defendant to receive a share of the land or other matter in suit in the event of success, the champertor carrying on or assisting to carry on the party's suit or defense at his own expense; the purchase of a suit or the right of suing. It is a punishable offense by common law and in some jurisdictions by statute.

The dawning of the day is near at hand for the weary-eyed passengers on the New York elevated roads. The company is actually installing the Pintsch gas-light fixtures on some of its cars, and it will soon be possible for a man to read his evening paper without running the risk of ruining his eyes. As against three pairs of smoky coal oil lamps, there will be four Pintsch lamps of four burners each, in every car of that portion of the rolling stock to be equipped this year. The striking comparison which will be afforded between the coal-oil lamps and the very excellent Pintsch light will show to New Yorkers in a forcible manner the miserable facilities for reading at night which they have been content to endure at the hands of the Manhattan Railway Company for years.

The new electric cars on the New York & Brooklyn Bridge are rapidly being placed in service, 12 more having been put in operation in the last few days. The electric plant will soon be in shape to handle the bridge traffic so that trains may be run on 45 seconds headway during the rush hours. The success of the electric system on the bridge shows what electric motive power may be made to successfully accomplish under the most exacting conditions.

About 75 rural editors visited New York city last week, and expressed great surprise on seeing our antiquated horse cars. They had almost forgotten how such unprogressive institutions looked. If they will come again 12 months hence we hope to be able by that time to show them that we have advanced in this respect to the level of their country towns.

The Prussian Government has wisely appropriated $12,000 for Roentgen-ray experiments during 1897. The scope of this important discovery is constantly widening.

The 400 guests at the Buffalo banquet are now known as the "Electrical 400."

THE NORTHWESTERN ELECTRICAL ASSOCIATION.

The Fifth Annual Convention Very Successfully Held at Milwaukee.

THE PROCEEDINGS AND PROGRAMME —PAPERS OF VALUE WERE DISCUSSED WITH ANIMATION BY THE PRACTICAL MEN IN ATTENDANCE.

The annual convention of the Northwestern Electrical Association was held at the Hotel Pfister, Milwaukee, Wis., January 20 to 22. Mr. H. C. Higgins, vice-president, called the convention to order in the hotel club-room at 11.40 A. M. A telegram from the president, Mr. W. B. Baker, announced that illness prevented his attendance.

After roll-call and report of secretary, Thos. R. Mercein, a vote of appreciation of the services of the secretary was unanimously adopted.

The programme was announced as follows:

WEDNESDAY.

Convene; roll-call; reading of minutes; president's address; reports of officers; reports of committees; elections to membership; election of officers; unfinished business; new business.
Paper, "Incandescent Lamps," by F. S. Terry, Chicago.
Paper, "Protective Devices for Transformers," by H. C. Wirt, Schenectady, N. Y.
Paper, "Insurance as Affected by Electrical Construction," by George S. McLaren, Milwaukee.
Paper, "Roentgen Ray Phenomena," by Caryl D. Haskins, Boston.
9.30 P. M., Banquet, Hotel Pfister.

THURSDAY.

Convene, 10 A. M.
Paper, "Safety Devices for Electrical Circuits," by Prof. W. M. Stine, Chicago.
Paper, "Gaseous Fuel as a Means of Cheapening Electricity," by Nelson W. Perry, New York.
Paper, "Electrical Supplies," by W. W. Low, Chicago.
Paper, "Electric Heating," by George Cutter, Chicago.
7.30 P. M., Theatre Party, Uihlein Theatre.

FRIDAY.

Convene, 10 A. M.—Closing session. Balance of day devoted to visiting electric plants, etc.

The secretary then read 28 applications for membership in the association, all of which were elected to membership.

On motion, a committee, consisting of Messrs. Debell, Copeland and Hawley, were appointed to arrange for proper remuneration for the secretary, whose excellent work was highly complimented.

Mr. F. S. Terry's paper was then read. This paper and others, with the discussion, will be published in the ELECTRICAL REVIEW in later issues.

AFTERNOON SESSION.

At 3.50 P. M. the election of two new members, the Chas. E. Gregory Company and the Electrical Exchange, of Chicago, occurred.

Mr. H. C. Wirt's paper followed, and after its discussion, was followed by the paper by Mr. Geo. S. McLaren, who received a vote of thanks. The paper was discussed at considerable length.

An amendment to the by-laws, dropping from the roll of members those in arrears one year for dues, was presented by Mr. Kountz.

It was voted that the statistics referred to by the secretary in his report as being obtained from the various central stations, be printed in pamphlet form and a copy sent gratis to each central station that has furnished the information and to each member of the association, without names, but with a key.

Mr. Hanley: I move that the secretary defer printing the report for 30 days, and that he in the meantime notify such members of the association as have not answered the questions heretofore referred to what the intention of the association is, and to ask them to furnish such information. Carried.

Mr. Doherty, of the special committee on municipal ownership, then made his report. It was followed with discussion by Messrs. Coleman, Buckley and Bean. The report was then adopted and referred to the executive committee, with authority to furnish means for the committee to carry on its work.

Mr. Debell: The committee on secretary's salary begs leave to report that it recommends that the salary of the secretary for the ensuing year be fixed at $150, and that $50 in addition to that amount be allowed as extra compensation for the last year's work.

We deem that $150 really is not as much as the work is worth, but we think for the coming year it is as much as the association can well afford, and we think the work done in the past year deserves a great deal more compensation than has been allowed for it up to the present time, and that is why we recommend that $50 be allowed for the past year's work, and that the salary for the coming year be $150.

Report unanimously adopted.

The association then adjourned to meet January 21, 1897, 10 A. M.

In the evening a lecture on X-ray phenomena was delivered by Mr. Caryl D. Haskins.

On Thursday, after listening to an address by Mr. Pierce on "Municipal Lighting," and by Mr. Schuette on a similar subject, the convention elected the following officers for the ensuing year: President, H. C. Higgins, of Marinette; first vice-president, G. L. Cole, of Beloit; John H. Harding, of La Porte, Ind.; secretary and treasurer, Thos. R. Mercein, of Milwaukee; board of directors: Messrs. Debell, of Sheboygan; Rau, of Milwaukee, and Bean, of St. Joseph, Mich.

The reading of Professor Stine's paper followed.

On motion of Mr. Schuette, it was voted to authorize the Protective Committee to engage some one to watch State legislation, and assess the costs on the plants in the jurisdiction of the association.

The amendment to the by-laws heretofore proposed by Mr. Kountz was then unanimously adopted.

Five applicants for membership were acted upon favorably, and the applicants declared duly elected members of the association.

La Crosse, Wis., was selected, after considerable discussion, as the next place of meeting.

Mr. W. W. Low, of Chicago, then read his paper on "Electrical Supplies." The association extended him a vote of thanks. Mr. N. W. Perry's paper was read by the secretary. Mr. Cutter's paper followed.

Adjourned *sine die*.

The American Association of Inventors.

The regular annual meeting of the American Association of Inventors and Manufacturers was held in Washington on the 19th instant. Dr. R. J. Gatling and Mr. Gardiner G. Hubbard, who have held the offices of president and first vice-president, respectively, since the organization of the association, five years ago, and under whose auspices it has been made so successful and useful, expressed a desire to be relieved from further service, and a change in the official board was therefore made. The newly elected officers are: President, F. H. Richards, Hartford, Ct.; first vice-president, J. C. Anderson, Chicago, Ill.; second vice-president, L. W. Serrell, New York city; third vice-president, Philip T. Dodge, New York city; fourth vice-president, M. C. Stone, Washington, D. C.; secretary and treasurer, Geo. C. Maynard, Washington, D. C. Members of the executive council: C. E. Billings, Hartford, Ct.; A. S. Bushnell, Springfield, Ohio; Robert S. Taylor, Fort Wayne, Ind.; Albert A. Pope, Boston, Mass.; Arthur Steuart, Baltimore, Md.; Marvin C. Stone, Washington, D. C.; James T. Du Bois, Washington, D. C.; G. H. Schulte, Milwaukee, Wis.; Lewis Miller, Akron, Ohio.

During the several sessions much important business was transacted, and papers relating to the patent interests were read and discussed. Several subjects of special importance to electrical inventors and manufacturers were considered.

The following resolutions embody the views of the association on some of these points:

Whereas, In carrying on the business of the Patent Office in the manner required by law, reference has to be made continuously to over 600,000 specifications and drawings of patents granted in this country, in addition to about the same number of patents granted in foreign countries, and to 50,000 or 60,000 books of reference; and,

Whereas, The accommodations of the Patent Office have for years been utterly inadequate for its necessary work, and the numerous appeals for more room have heretofore been unheeded, notwithstanding the fact that there is over $4,000,000 to the credit of the patent fund; therefore,

Resolved, That this association does most earnestly and emphatically enter its protest against the continuance of this great injustice to the inventors and manufacturers of the country, and urges upon Congress prompt measures for the removal of the Department of the Interior from the Patent Office, and the proper equipment of the building in the most approved manner for the prompt and reliable transaction of the business of the Patent Office; and,

Resolved, That as the Patent Office was originally erected for the use of the bureau, and largely at the expense of the patent fund, we protest against the transfer of the Patent Office to any other building.

Whereas, The United States did, on the 7th day of June, 1887, adhere to the Convention for the Protection of Industrial Property concluded at Paris, March 20, 1883; and,

Whereas, The American Association of Inventors and Manufacturers heartily appreciates and approves the objects and aims of the international convention for the protection of industrial property (inventions, trade-marks and commercial names); and,

Whereas, The convention grants to citizens of the United States the right to publish, use, work or exploit their inventions in any of the nations adhering to the convention during a period of seven months after the date of their applications for patent in this country, and their trade-marks four months; and,

Whereas, The convention also provides that the citizens of any nation a member of the union, whose local law extends equal privileges to the citizens of all other nations members of the union, shall have the right through the State Department of their own governments, to register their trade-marks in the International Bureau established under said convention, and after such registration, to be protected in all of the countries members of the union, as fully as if they had registered in each of the individual nations members of the union; and,

Whereas, Congress has passed no legislation to carry out the terms and spirit of this convention; therefore, it is

Resolved, That it is the earnest desire of this association that the executive and legislative branches of the Government of the United States take such steps as may be necessary to carry out the terms and obligations of the convention, and to secure to the citizens of the United States all of the advantages which may accrue therefrom.

During the past year the association, through its committee on legislation, has given careful attention to proposed amendments to the patent laws which have come before Congress, and its efforts have been largely instrumental in securing the passage of a bill by the House of Representatives, repealing the statute which terminated the life of a United States patent at the same time that the foreign patent having the shortest term expired. Under the present law a patent, although granted for 17 years, is liable to expire at almost any time without the fault of the inventor, due to the fact that he has attempted to patent his invention abroad, and filed his application there before the issue of his United States patent. Under the new bill, which will undoubtedly become a law before the close of the present session of Congress, when an inventor receives a patent it will run the full term of 17 years. The importance of this amendment can not be overestimated.

Among the electrical members of the association are Elihu Thomson, Chas. F. Brush, Thomas D. Lockwood, Henry A. Reed, Leonard F. Requa, Nikola Tesla, Prof. Cyrus F. Brackett, Elias E. Ries, Emile Berliner, A. G. Davis, Harry H. Blades, Herman Hollerith and Charles S. Tainter.

The Crocker-Wheeler Installation in the New Astor Hotel.

The Crocker-Wheeler installation in the new Astor hotel is probably the most perfect electrical ventilating equipment ever erected. Thomas J. Fay and Associates, the New York agents and general exporters, 143 Liberty street, New York, have the execution of the contract.

The motors will be direct-connected to blowers and exhausters, and the installation includes the following: Two 24-horse-power motors, maximum speed, 190 revolutions per minute; one 30-horse-power motor, maximum speed, 140 revolutions per minute; one 32-horse-power motor, maximum speed, 175 revolutions per minute; one 40-horse-power motor, maximum speed, 115 revolutions per minute; one 60-horse-power motor, maximum speed, 175 revolutions per minute; one 90 horse-power motor, maximum speed, 140 revolutions per minute.

The Standard Edison Fluoroscopes and Fluorescence Screens.

From the time that the practical application of the fluoroscope and fluorescence screen was apparent, Messrs. Aylsworth and Jackson devoted much energy, in their laboratories at Orange, New Jersey, to the production of this part of the X-ray apparatus, and the results have been the acceptance by the scientific world of their Edison fluoroscopes and screens as the standard. In line with this work, some important facts as to the nature of fluorescent crystals have been established.

X Rays Detect Adulteration.

A German observer points out, says *The Medical Times*, that by the use of the X ray brick dust can be traced in Cayenne pepper, sand in spices and chalk in flour.

X RAYS, APPARATUS AND METHODS.

ABSTRACT OF PAPER READ BEFORE THE ELECTRICAL SECTION OF THE FRANKLIN INSTITUTE, PHILADELPHIA, DECEMBER 1, 1896, BY ELMER G. WILLYOUNG AND H. LYMAN SAYEN.

That Professor Roentgen's discovery of the X ray has initiated many lines of thought promising to greatly extend our knowledge of physical phenomena, as well as to revise many

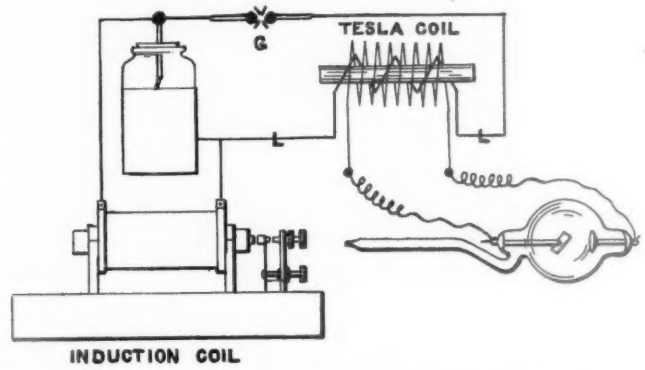


FIG. 1.—"X-RAYS, APPARATUS AND METHODS."—DIAGRAM OF TESLA HIGH-FREQUENCY COIL.

of our previously accepted views, is generally admitted. That the practical results accruing to humanity by virtue of the applications of this discovery in surgical and medical practice are of even greater promise and value is equally conceded. The writers have been engaged for a number of months past in developing apparatus and methods for practical work with especial reference to the needs of the physician and surgeon. For conciseness we split the matter under discussion into a series of subordinate heads, each of which we shall briefly treat.

THE COIL OR GENERATING SOURCE.

Thus far the only apparatus known which will produce X rays readily and profusely is the "transformer." Not the commercial transformer of every-day use, however, but its earlier and, for most purposes, less efficient form, the "induction coil." Such a transformer gives exceedingly great electro-motive forces, capable of producing discharge over long air gaps. When the discharge from such a coil is passed through properly exhausted and constructed tubes, we have a very vigorous generation of X rays.

Two arrangements of the induction coil are advocated. The one is known as the Tesla or "high-frequency" coil, and the other is the direct and old-fashioned use of the simple induction coil, in which the high secondary electro-motive force is delivered direct to the terminals of the tube.

THE HIGH-FREQUENCY COIL

consists of two induction coils, the induced secondary current of the first being used to charge a Leyden jar. The primary of the second coil is joined, in series with a spark gap, to the two coatings of the Leyden jar. When the Leyden jars are fully charged they discharge across the air gap, this discharge being, by well known laws of electrical circuit flow, an oscillating one of exceedingly high frequency—millions or more oscillations per second. We thus have the primary of the second coil excited by an alternating current of exceedingly great voltage and frequency, so that *its* secondary produces a discharge of still *greater* electro-motive force and of this same high frequency. So great is this final electro-motive force that it is generally necessary to immerse the entire second coil, primary and all, in a tank of oil, since no solid insulation has yet been found capable of standing these great electro-motive forces without breakdown.

To excite the Tesla coil we may use either an interrupted direct current or an ordinary alternating circuit joined directly to the primary of the first coil. But the final result is, in either case, an alternating, high-potential, high-frequency current. In the tube, therefore, we also have an alternating discharge.

THE INDUCTION COIL.

The primary must be excited by an interrupted direct current, which may

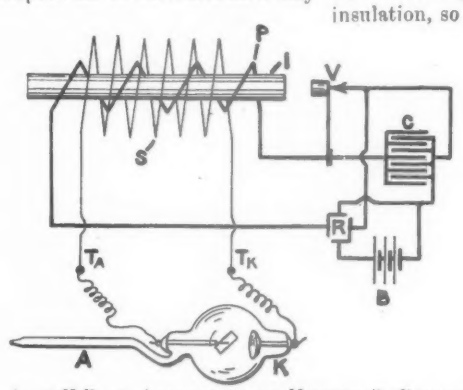


FIG. 2.—"X-RAYS, APPARATUS AND METHODS."—CONNECTIONS OF SIMPLE INDUCTION COIL.

be supplied by primary batteries, storage batteries, or a commercial circuit, as convenience and inclination may elect. The secondary is joined directly to the tube terminals. Around the primary is joined a condenser. At break this condenser charges (thus preventing the extra induced current due to the large self-induction of the primary), but, being "short circuited" by the primary, at once discharges about the iron core in a direction opposite to the regular "make" current, thus reducing (if correctly proportioned) the magnetic intensity of the iron core to zero. All this takes place so quickly that the practical effect of the action is merely to assist and intensify the dropping off of the core's magnetism—to shove it along—hasten it. Considering the secondary, now, we find that we shall have at *break* an induced discharge of greatly higher electro-motive force than the discharge at *make*, owing to the falling off of the core's magnetism *at* break being greatly sharper than its growth at make. The effect of this is to give secondary discharges in *one direction only* at all times when the parallel spark gap is not *greatly* shorter than the *maximum* obtainable spark gap for that particular condition of running the coil, the *make* induced current at such times being of too small electro-motive force to get across the gap at all. This is always the condition when X-ray tubes are used. A further function of the condenser is to suppress *burning* at the "break" terminals or points of interruption by taking up the energy of the magnetic discharge of the coil.

In the construction of the induction coil a number of points may be noted. Our secondaries are wound in sections one-eighth-inch thick (according to the plan originally proposed, we believe, by Ritchie). These sections are separated from one another by a large number of disks of paper of a brand especially selected as free from carbon particles and baked at a temperature a little below charring point for some time immediately before use—this to drive out moisture. These sections are then assembled and immediately immersed in a special insulation composition having a very high melting point and some slight viscosity at all temperatures. Paraffine we absolutely prohibit, as being apt to crack and absorb moisture. After cooking for some time in the insulation, so as to drive out the last traces of moisture, the stack of sections is subjected to a further treatment, by which it is finally cooled, with *all air removed*. This we consider a point of the highest importance, as air present anywhere in the secondary becomes electrified and bombards to and fro, gradually softening the insulation and eventually breaking down the coil. (See Tesla's writings on "High-Frequency Phenomena" for confirmation of this point.) With this plan of construction we have no static leaks of energy or small direct leaks within the coil itself, and deliver the full energy of discharge at the secondary terminals. We find ourselves able to secure in this way a full inch of spark, in all sizes of coils, with considerably less than one pound of wire, No. 34 Brown & Sharpe. We believe that, more than anything else, the large quantities of wire required to produce a given spark length with many of the coils now in use is due to the presence of air and consequent loss of energy by static bombardment in the secondary. As regards the insulating composition used by us, we may say that we find its power of resistance to spark discharge to be four or five times that of hard rubber. In the arrangement of our secondary we separate it from the primary by a heavy hard-rubber tube and, in addition, by a tube of this composition.

THE ADJUSTABLE CONDENSER.

A coil is working to best advantage when there is a certain definite relation between its primary current, secondary spark distance and condenser capacity. Frequency of break must also be considered. As coils have heretofore been built, however, the condenser value has been fixed once for all and admits of no change, albeit both spark gap and primary current, and primary current may be so changed. To remedy this we have devised a form of switch, by means of which the condenser capacity may be shifted at will and instantly by simply turning the switch. The effect upon the secondary discharge is very marked, both volume and musical note of the spark changing with the position of the switch. We have made some experiments in the use of a condenser in the parallel *with the primary*. The volume of the secondary discharge seems, in many cases, to be greatly increased. We find this idea exceedingly convenient in general experimental work with alternating currents; indeed, it being possible with it to alter condenser capacity as quickly and as readily as we may self-induction or resistance.

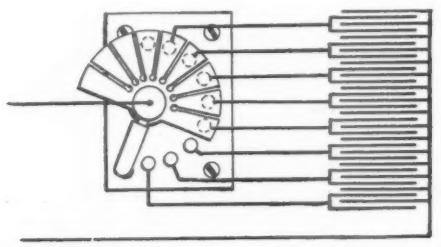


FIG. 3 —"X-RAYS, APPARATUS AND METHODS."—THE AUTHORS' FORM OF SWITCH.

In arranging coils to operate from few or many cells of battery, it is, of course, merely a matter of winding the primary of coarse or fine wire, the number of ampere turns being kept the same. It is interesting to note, as we have noted experimentally many times, that the larger the primary electro-motive force the smaller must be the condenser capacity employed, and *vice versa*. This is, of course, only to be expected, since capacity and self-induction are inverse functions of one another.

PRIMARY CURRENT.

This may be either from primary batteries, storage batteries, or from a

commercial direct-current circuit. Primary batteries have too high resistance to give sufficient current for coils of much size—say four-inch and over—unless joined in parallel, and then we need a number of such groups to secure the requisite electro-motive force. They are a nuisance to attend to, soon run down and are expensive to operate. Storage batteries are exceedingly satisfactory, are comparatively inexpensive to operate and require practically no attention. Charging them is more or less of a nuisance, however, especially where they must be sent out of the building, as they usually must, besides throwing the entire apparatus out of use while charging is going on, unless one have a reserve set of batteries.

The utilization of a direct commercial circuit, such as the Edison 110-volt E. G., where such is available, is in every way the most convenient and satisfactory. Until Professor Roentgen's discovery, no method of

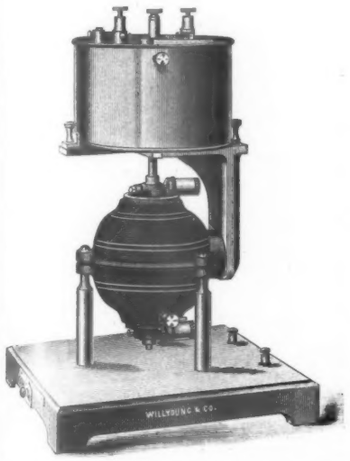


Fig. 4.—"X Rays, Apparatus and Methods."—The Authors' Device for Operating Coils on Commercial Circuits.

operating large coils upon such a circuit had been developed. Recently, however, several methods have been brought out, notably that of the "air break" with air blast to blow out the spark, as used by Dr. Wm. J. Morton, Dr. M. I. Pupin and others. We have devised a form of apparatus to accomplish this purpose. A Lundell one-twelfth-horse-power motor is supported upon a base with its shaft vertical. A casting attached to the motor supports above the latter a copper can made up of two concentric cylinders joined by a ring below, so that the shaft passes up through the inner cylinder and thus avoids the necessity of a stuffing box. From the shaft is hung, well within the can, a heavy brass wheel having stretches of insulating slate let into its periphery. A hard-rubber lid fits over the top of the can. Mounted upon this lid are two brushes, one bearing against the wheel periphery and the one against the shaft; suitable springs and screws allow the brush tension to be varied. From the commercial circuit leads are brought to these two brushes, the current being first passed through the primary of the coil and a rheostat in series. Before the lid is put in place, the can is filled with distilled water; ordinary hydrant water will answer, although its usual impurity causes the water to soon dirty, besides allowing a certain amount of electrolysis during use. With distilled water the break may be run for a number of hours without change of the water, and very little heating takes place. The real function of the water is not so much to drown the spark as to prevent heating, although it does, of course, also assist in quenching the spark. But a condenser is the real spark extinguisher, and this we connect around the break just as we would around an ordinary vibrating break.

The advantages of this break over all forms of vibrating break thus far known and over other forms of rotary break are:

A. Convenience: Mere throwing of a switch being all that is required to start and stop the apparatus.

B. Noiselessness: Only the drowsy hum of the motor being heard.

C. Reliability: No chance of sticking, as with vibrating breaks.

D. Variable rate of break, secured by adjusting rheostat in base of motor.

E. Smooth, unvarying fluoroscopic images, owing to the much larger number of breaks per unit of time.

Two milled heads at top of can permit its lid (carrying brushes) to be withdrawn. A similar head at top of shaft loosens break-wheel, and two heads at bottom of can allow it to be lifted away for cleaning and renewal and replenishing of water.

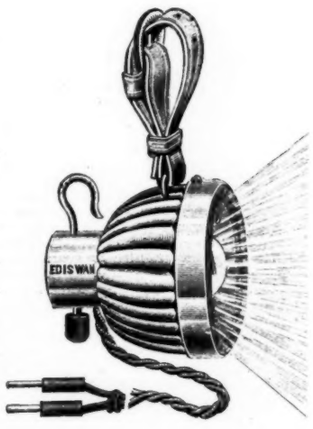
We use three makes and three breaks per revolution and find best results at from 1,200 to 1,400 revolutions per minute (equal to 3,600 to 4,800 interruptions). We may secure as many as 2,000 revolutions (6,000 interruptions) per minute by cutting out the motor regulator.

In operation, the brush bearing upon break-wheel should be *positive*, so as to prevent any electrolysis of the break-wheel. We have often broken between 15 and 20 amperes through this wheel for a considerable length of time without any overheating or overwear of the wheel. Should the wheel wear in time to an undesirable degree, it may be removed and turned down. Provision is also made for replacing the brushes when desired.

GENERAL CONSIDERATIONS REGARDING BREAK FREQUENCY.

The question as to whether there is a certain best frequency of break for a given coil or tube, or both, has puzzled not a few. Very little has been experimentally determined regarding this point. It is certain, however, that, with a given coil or tube, shortness of exposure is *not* exactly inversely as the number of breaks. Indeed, it is often far from being so. Some of the best X-ray pictures that have been taken have been by use of the old "hammer" break of Ritchie, and four or five clicks of the break have sufficed. Using the same tube and coil, but a rapidly vibrating or rotary break, required 40 or 50 breaks to accomplish the same results. It would appear, hence, that the energy of X-ray radiation *per break* is a function of the number of breaks per unit of time.

We are inclined to believe that this is a matter purely of the "time constant" of the coil. The iron of the core requires a certain time to magnetize or demagnetize. With the breaks few, ample time is given for this process; but when the breaks become rapid this is no longer possible, so that the secondary electro-motive force falls. This may easily be verified by observing the maximum spark length of any coil. With single breaks few and far between, we get much longer spark maxima than if the breaks are frequent. The thickness of the sparks is also greatly increased. If, however, we increase the primary electro-motive force for the more rapid break, we may bring up the secondary spark length to the value given by the single breaks. We should thus be able to shorten the exposure as much as we please by merely increasing the rate of break



The "Cat-Eye" Electric Bicycle Lamp.

and the primary electro-motive force at the same time. But here we are limited by the *tube*, which can not *dissipate* more than a certain definite amount of energy in a given time, and will break down if overdriven. We see, therefore, that, whether we use slow breaks or fast breaks, the actual time of exposure remains practically the same, the few breaks requiring to be distributed over the same *time* as the much larger number of rapid breaks. All this, of course, applies to the photographic plate. For fluoroscopy we require rapid breaks, in order to escape the otherwise distressing flickering.

In the above connection particular attention is directed to one point—the rate of break *must not be too great*. If it is, the iron no longer has time to magnetize and demagnetize. The result is an *alternating* secondary discharge instead of the *direct* discharge desired, and this means blackening of the tube, rapid fluctuations of the vacuum and general deterioration of the tube. *We doubt whether with any coil of size suitable for X-ray work a rate of break greater than 5,000 per minute should ever be employed.*

[*To be concluded.*]

Dr. Fleming's Lecture on the X Ray.

In concluding his course of lectures at the London Institution, Prof. J. A. Fleming described the wonders of the X rays. As reported in the *World of Science*, he explained the part which Mr. Crookes had had in the discovery, and experimented with some high-vacuum tubes. When electricity was applied to these tubes the rays of light shooting off from a negative pole struck against the walls of the tube with such force as to make it vibrate, and a green light was produced inside the tube. Rays of light were also produced outside the tube. These were the wonderful X rays, and though they were strong enough to see through wood, leather and many other substances, they could not be seen by the eye.

It was, Professor Fleming thought, quite as well that the eye did not utilize these rays, for we should probably see more than our neighbors would approve of. It would, for instance, be no use to say you were out to a visitor if you were not, as he would be able to see through wooden doors as easily as he now could see through a window. Already this discovery had been a great aid to surgery, and although it was not much more than a year old, such progress had been made that with the rays one could now look inside a man and see his heart beating. Doctors would, he thought, soon be able to see the whole of the interior of human beings.

Pictures of opaque substances photographed through blocks of wood and other covers were exhibited on a lantern screen, not the least interesting being the bones of a mummy 4,000 years old. They were beautiful pictures, showing with great distinctness every bone and every joint. These were taken with the X rays through all the coverings which are required to preserve a 4,000-year-old mummy from contact with the air. The visitors were also shown how they could examine their own bones without the aid of photography, merely using a prepared screen and the X rays.

The "Cat-Eye" Electric Bicycle Lamp.

The Ediswan Company, of London, are the manufacturers of the "cat-eye" electric bicycle lamp, which is illustrated herewith and which was recently described in London *Lightning*. The lamp is provided with a strap and buckle, and also with a hook attachment. It can be either suspended from a button-hole or attached to a bar, or rail, or bracket, or ledge of any kind. The lamp has a powerful lens, and gives amply sufficient light for purposes of reading or examination. The illustration shows the lamp with a strap at the top for fastening it to any convenient place, with a hook for attaching it to the button-hole and with flexible wires for making connections with the battery. There is also furnished an attachment for cycles, into which the lamp will fit. The lamp is driven by a small storage battery. The weight of the complete set is two and one half pounds and the duration of the charge from eight to ten hours.

TESLA ON ELECTRICITY.

HIS ADDRESS IN FULL ON THE OCCASION OF THE COMMEMORATION OF THE INTRODUCTION OF NIAGARA FALLS POWER IN BUFFALO AT THE ELLICOTT CLUB, JANUARY 12, 1897.

I have scarcely had courage enough to address an audience on a few unavoidable occasions, and the experience of this evening, even as disconnected from the cause of our meeting, is quite novel to me. Although in those few instances, of which I have retained agreeable memory, my words have met with a generous reception, I never deceived myself, and knew quite well that my success was not due to any excellency in the rhetorical or demonstrative art. Nevertheless, my sense of duty to respond to the request with which I was honored a few days ago was strong enough to overcome my very grave apprehensions in regard to my ability of doing justice to the topic assigned to me. It is true, at times—even now, as I speak—my mind feels full of the subject, but I know that, as soon as I shall attempt expression, the fugitive conceptions will vanish, and I shall experience certain well known sensations of abandonment, chill and silence. I can see already your disappointed countenances and can read in them the painful regret of the mistake in your choice.

These remarks, gentlemen, are not made with the selfish desire of winning your kindness and indulgence on my shortcomings, but with the honest intention of offering you an apology for your disappointment. Nor are they made—as you might be disposed to think—in that playful spirit which, to the enjoyment of the listeners, is often displayed by belated speakers. On the contrary, I am deeply earnest in my wish that I were capable of having the fire of eloquence kindled in me, that I might dwell in adequate terms on this fascinating science of electricity, on the marvelous development which electrical annals have recorded and which, as one of the speakers justly remarked, stamp this age as the Electrical Age, and particularly on the great event we are commemorating this day. Unfortunately, this my desire must remain unfulfilled, but I am hopeful that in my formless and incomplete statements, among the few ideas and facts I shall mention there may be something of interest and usefulness, something befitting this unique occasion.

Gentlemen, there are a number of features clearly discernible in, and characteristic of, human intellectual progress in more recent times—features which afford great comfort to the minds of all those who have really at heart the advancement and welfare of mankind.

First of all, the inquiry, by the aid of the microscope and electrical instruments of precision, into the nature of our organs and senses, and particularly of those through which we commune directly with the outside world and through which knowledge is conveyed to our minds, has revealed their exact construction and mode of action, which is in conformity with simple and well established physical principles and laws. Hence the observations we make and the facts we ascertain by their help are *real* facts and observations, and our knowledge is *true* knowledge. To illustrate: Our knowledge of form, for instance, is dependent upon the positive fact that light propagates in straight lines, and, owing to this, the image formed by a lens is exactly similar to the object seen. Indeed, my thoughts in such fields and directions have led me to the conclusion that most all human knowledge is based on this simple truth, since practically every idea or conception—and therefore all knowledge—presupposes visual impressions. But if light would not propagate in accordance with the law mentioned, but in conformity with any other law which we might presently conceive, whereby not only the image might not bear any likeness to the object seen, but even the images of the same object at different times or distances might not resemble each other, then our knowledge of form would be very defective, for then we might see, for example, a three-cornered figure as a six or twelve-cornered one. With the clear understanding of the mechanism and mode of action of our organs, we remove all doubts as to the *reality* and *truth* of the impressions received from the outside, and thus we bar out—forever, we may hope—that unhealthy speculation and skepticism into which formerly even strong minds were apt to fall.

Let me tell you of another comforting feature. The progress in a measured time is nowadays more rapid and greater than it ever was before. This is quite in accordance with the fundamental law of motion, which commands acceleration and increase of momentum or accumulation of energy under the action of a continuously acting force and tendency, and is the more true as every advance weakens the elements tending to produce friction and retardation. For, after all, what *is* progress, or—more correctly—development, or evolution, if not a movement, infinitely complex and often unscrutinizable, it is true, but nevertheless exactly determined in quantity as well as in quality of motion by the physical conditions and laws governing? This feature of more recent development is best shown in the rapid merging together of the various arts and sciences by the obliteration of the hard and fast lines of separation, of borders, some of which only a few years ago seemed unsurpassable, and which, like veritable Chinese walls, surrounded every department of inquiry and barred progress. A sense of connectedness of the various apparently widely different forces and phenomena we observe is taking possession of our minds, a sense of deeper understanding of nature as a whole, which, though not yet quite clear and defined, is keen enough to inspire us with the confidence of vast realizations in the near future.

But these features chiefly interest the scientific man, the thinker and reasoner. There is another feature which affords us still more satisfaction and enjoyment, and which is of still more universal interest, chiefly because of its bearing upon the welfare of mankind. Gentlemen, there is an influence which is getting strong and stronger day by day, which shows itself more and more in all departments of human activity, an influence most fruitful and beneficial—the influence of the artist. It was a happy day for the mass of humanity when the artist felt the desire of becoming a physician, an electrician, an engineer or mechanician or—whatnot—a mathematician or a financier; for it was he who wrought all these wonders and grandeur we are witnessing. It was he who abolished that small, pedantic, narrow-grooved school teaching which made of an aspiring student a galley-slave, and he who allowed freedom in the choice of subject of study according to one's pleasure and inclination, and so facilitated development.

Some, who delight in the exercise of the powers of criticism, call this an assymetrical development, a degeneration or departure from the normal, or even a degradation of the race. But they are mistaken. This is a welcome state of things, a blessing, a wise subdivision of labors, the establishment of conditions most favorable to progress. Let one concentrate all his energies in one single great effort, let him perceive a single truth, even though he be consumed by the sacred fire, then millions of less gifted men can easily follow. Therefore it is not as much quantity as quality of work which determines the magnitude of the progress.

It was the artist, too, who awakened that broad philanthropic spirit which, even in old ages, shone in the teachings of noble reformers and philosophers, that spirit which makes men in all departments and positions work not as much for any material benefit or compensation—though reason may command this also—but chiefly for the sake of success, for the pleasure there is in achieving it and for the good they might be able to do thereby to their fellow-men. Through his influence types of men are now pressing forward, impelled by a deep love for their study, men who are doing wonders in their respective branches, whose chief aim and enjoyment is the acquisition and spread of knowledge, men who look far above earthly things, whose banner is Excelsior! Gentlemen, let us honor the artist, let us thank him, let us drink his health!

Now, in all these enjoyable and elevating features which characterize modern intellectual development, electricity, the expansion of the science of electricity, has been a most potent factor. Electrical science has revealed to us the true nature of light, has provided us with innumerable appliances and instruments of precision, and has thereby vastly added to the exactness of our knowledge. Electrical science has disclosed to us the more intimate relation existing between widely different forces and phenomena and has thus led us to a more complete comprehension of Nature and its many manifestations to our senses. Electrical science, too, by its fascination, by its promises of immense realizations, of wonderful possibilities chiefly in humanitarian respects, has attracted the attention and enlisted the energies of the artist; for where is there a field in which his God-given powers would be of greater benefit to his fellow-men than this unexplored, almost virgin, region, where, like in a silent forest, a thousand voices respond to every call?

With these comforting features, with these cheering prospects, we need not look with any feeling of incertitude or apprehension into the future. There are pessimistic men, who, with anxious faces, continuously whisper in your ear that the nations are secretly arming—arming to the teeth; that they are going to pounce upon each other at a given signal and destroy themselves; that they are all trying to outdo that victorious, great, wonderful German army, against which there is no resistance, for every German has the discipline in his very blood—every German is a soldier. But these men are in error. Look only at our recent experience with the British in that Venezuela difficulty. Two other nations might have crashed together, but not the Anglo-Saxons; they are too far ahead. The men who tell you this are ignoring forces which are continually at work, silently but resistlessly—forces which say Peace!

There is the genuine artist, who inspires us with higher and nobler sentiments, and makes us abhor strife and carnage. There is the engineer, who bridges gulfs and chasms, and facilitates contact and equalization of the heterogeneous masses of humanity. There is the mechanic, who comes with his beautiful time and energy-saving appliances, who perfects his flying machine, not to drop a bag of dynamite on a city or vessel, but to facilitate transport and travel. There, again, is the chemist, who opens new resources and makes existence more pleasant and secure; and there is the electrician, who sends his messages of peace to all parts of the globe. The time will not be long in coming when those men who are turning their ingenuity to inventing quick-firing guns, torpedoes and other implements of destruction—all the while assuring you that it is for the love and good of humanity—will find no takers for their odious tools, and will realize that, had they used their inventive talent in other directions, they might have reaped a far better reward than the sestertia received. And then, and none too soon, the cry will be echoed everywhere. Brethren, stop these highhanded methods of the strong, these remnants of barbarism so inimical to progress! Give that valiant warrior opportunities for displaying a more commendable courage than that he shows when, intoxicated with victory, he rushes to the destruction of his fellow-men. Let him toil day and night with a small chance of achieving and yet be unflinching; let him challenge the dangers of exploring the heights of the air and the depths of the sea; let him brave the dread of the plague, the heat of the tropic desert and the ice of the polar region. Turn your energies to warding off the common enemies and dangers, the perils that are all around you, that threaten you in the air you breathe, in the water you drink, in the food you consume. Is it not strange, is it not shame, that we, beings in the highest state of development in this our world, beings with such immense powers of thought and action, we, the masters of the globe, should be absolutely at the mercy of our unseen foes, that we should not know whether a swallow of food or drink brings joy and life or pain and destruction to us! In this most modern and sensible warfare, in which the bacteriologist leads, the services electricity will render will prove invaluable. The economical production of high-frequency currents, which is now an accomplished fact, enables us to generate easily and in large quantities ozone for the disinfection of the water and the air, while certain novel radiations recently discovered give hope of finding effective remedies against ills of microbic origin, which have heretofore withstood all efforts of the physician. But let me turn to a more pleasant theme.

I have referred to the merging together of the various sciences or departments of research, and to a certain perception of intimate connection between the manifold and apparently different forces and phenomena. Already we know, chiefly through the efforts of a bold pioneer, that light, radiant heat, electrical and magnetic actions are closely related, not to say identical. The chemist professes that the effects of combination and separation of bodies he observes are due to electrical forces, and the physician and physiologist will tell you that even life's progress is electrical. Thus electrical science has gained a universal meaning, and with right this age can claim the name "Age of Electricity."

I wish much to tell you on this occasion—I may say I actually burn for desire of telling you—what electricity really *is*, but I have very strong reasons, which my co-workers will best appreciate, to follow a precedent established by a great and venerable philosopher, and I shall not dwell on this purely scientific aspect of electricity.

There is another reason for the claim which I have before stated which is even more potent than the former, and that is the immense development in all electrical branches in more recent years and its influence upon other departments of science and industry. To illustrate this influence I only need to refer to the steam or gas engine. For more than half a century the steam engine has served the innumerable wants of man. The work it was called to perform was of such variety and the conditions in each case were so different that, of necessity, a great many types of engines have resulted. In the vast majority of cases the problem put before the engineer was not, as it should have been, the broad one of converting the greatest possible amount of heat energy into mechanical power, but it was rather the specific problem of obtaining the mechanical power in such form as to be best suitable for general use. As the reciprocating motion of the piston was not convenient for practical purposes, except in very few instances, the piston was connected to a crank, and thus rotating motion was obtained, which was more suitable and preferable, though it involved numerous disadvantages incident to the crude and wasteful means employed. But until quite recently there were at the disposal of the engineer, for the transformation and transmission of the motion of the piston, no better means than rigid mechanical connections. The past few years have brought forcibly to the attention of the builder the electric motor, with its ideal features. Here was a mode of transmitting mechanical motion simpler by far, and also much more economical. Had this mode been perfected earlier, there can be no doubt that, of the many different types of engine, the majority would not exist, for just as soon as an engine was coupled with an electric generator a type was produced capable of almost universal use. From this moment on there was no necessity to endeavor to perfect engines of special designs capable of doing special kinds of work. The engineer's task became now to concentrate all his efforts upon one type, to perfect one kind of engine—the best, the universal, the engine of the immediate future; namely, the one which is best suitable for the generation of electricity. The first efforts in this direction gave a strong impetus to the development of the reciprocating high-speed engine, and also to the turbine, which latter was a type of engine of very limited practical usefulness, but became, to a certain extent, valuable in connection with the electric generator and motor. Still, even the former engine, though improved in many particulars, is not radically changed, and even now has the same objectionable features and limitations. To do away with these as much as possible, a new type of engine is being perfected in which more favorable conditions for economy are maintained which expands the working fluid with utmost rapidity and loses little heat on the walls, an engine stripped of all usual regulating mechanism—packings, oilers and other appendages—and forming part of an electric generator; and in this type, I may say, I have implicit faith.

The gas or explosive engine has been likewise profoundly affected by the commercial introduction of electric light and power, particularly in quite recent years. The engineer is turning his energies more and more in this direction, being attracted by the prospect of obtaining a higher thermodynamic efficiency. Much larger engines are now being built, the construction is constantly improved, and a novel type of engine, best suitable for the generation of electricity, is being rapidly evolved.

There are many other lines of manufacture and industry in which the influence of electrical development has been even more powerfully felt. So, for instance, the manufacture of a great variety of articles of metal, and especially of chemical products. The welding of metals by electricity, though involving a wasteful process, has, nevertheless, been accepted as a legitimate art, while the manufacture of metal sheet, seamless tubes and the like affords promise of much improvement. We are coming gradually, but surely, to the fusion of bodies and reduction of all kinds of ores—even of iron ores—by the use of electricity, and in each of these departments great realizations are probable. Again, the economical conversion of ordinary currents of supply into high-frequency currents opens up new possibilities, such as the combination of the atmospheric nitrogen and the production of its compounds; for instance, ammonia and nitric acid, and their salts, by novel processes.

The high-frequency currents also bring us to the realization of a more economical system of lighting; namely, by means of phosphorescent bulbs or tubes, and enable us to produce with these appliances light of practically any candle-power. Following other developments in purely electrical lines, we have all rejoiced in observing the rapid strides made, which, in quite recent years, have been beyond our most sanguine expectations. To enumerate the many advances recorded is a subject for the reviewer, but I can not pass without mentioning the beautiful discoveries of Lenard and Roentgen, particularly the latter, which have found such a powerful response throughout the scientific world that they have made us forget, for a time, the great achievement of Linde in Germany, who has effected the liquefaction of air on an industrial scale by a process of continuous cooling; the discovery of argon by Lord Rayleigh and Professor Ramsay, and the splendid pioneer work of Professor Dewar in the field of low temperature research. The fact that the United States have contributed a very liberal share to this prodigious progress must afford to all of us great satisfaction. While honoring

the workers in other countries and all those who, by profession or inclination, are devoting themselves to strictly scientific pursuits, we have particular reasons to mention with gratitude the names of those who have so much contributed to this marvelous development of electrical industry in this country. Bell, who, by his admirable invention enabling us to transmit speech to great distances, has profoundly affected our commercial and social relations, and even our very mode of life; Edison, who, had he not done anything else beyond his early work in incandescent lighting, would have proved himself one of the greatest benefactors of the age; Westinghouse, the founder of the commercial alternating system; Brush, the great pioneer of arc lighting; Thomson, who gave us the first practical welding machine, and who, with keen sense, contributed very materially to the development of a number of scientific and industrial branches; Weston, who once led the world in dynamo design, and now leads in the construction of electric instruments; Sprague, who, with rare energy, mastered the problem and insured the success of practical electrical railroading; Acheson, Hall, Willson and others, who are creating new and revolutionizing industries here under our very eyes at Niagara. Nor is the work of these gifted men nearly finished at this hour. Much more is still to come, for, fortunately, most of them are still full of enthusiasm and vigor. All of these men and many more are untiringly at work investigating new regions and opening up unsuspected and promising fields. Weekly, if not daily, we learn through the journals of a new advance into some unexplored region, where at every step success beckons friendly, and leads the toiler on to hard and harder tasks.

But among all these many departments of research, these many branches of industry, new and old, which are being rapidly expanded, there is one dominating all others in importance—one which is of the greatest significance for the comfort and welfare, not to say for the existence, of mankind, and that is the electrical transmission of power. And in this most important of all fields, gentlemen, long afterwards, when time will have placed the events in their proper perspective, and assigned men to their deserved places, the great event we are commemorating to-day will stand out as designating a new and glorious epoch in the history of humanity—an epoch grander than that marked by the advent of the steam engine. We have many a monument of past ages; we have the palaces and pyramids, the temples of the Greek and the cathedrals of Christendom. In them is exemplified the power of men, the greatness of nations, the love of art and religious devotion. But that monument at Niagara has something of its own, more in accord with our present thoughts and tendencies. It is a monument worthy of our scientific age, a true monument of enlightenment and of peace. It signifies the subjugation of natural forces to the service of man, the discontinuance of barbarous methods, the relieving of millions from want and suffering. No matter what we attempt to do, no matter to what fields we turn our efforts, we are dependent on power. Our economists may propose more economical systems of administration and utilization of resources, our legislators may make wiser laws and treaties, it matters little; that kind of help can be only temporary. If we want to reduce poverty and misery, if we want to give to every deserving individual what is needed for a safe existence of an intelligent being, we want to provide more machinery, more power. Power is our mainstay, the primary source of our many-sided energies. With sufficient power at our disposal we can satisfy most of our wants and offer a guaranty for safe and comfortable existence to all, except perhaps to those who are the greatest criminals of all—the voluntarily idle.

The development and wealth of a city, the success of a nation, the progress of the whole human race, is regulated by the power available. Think of the victorious march of the British, the like of which history has never recorded. Apart from the qualities of the race, which have been of great moment, they own the conquest of the world to—coal. For with coal they produce their iron; coal furnishes them light and heat; coal drives the wheels of their immense manufacturing establishments, and coal propels their conquering fleets. But the stores are being more and more exhausted, the labor is getting dearer and dearer, and the demand is continuously increasing. It must be clear to every one that soon some new source of power supply must be opened up, or that at least the present methods must be materially improved. A great deal is expected from a more economical utilization of the stored energy of the carbon in a battery; but while the attainment of such a result would be hailed as a great achievement, it would not be as much of an advance towards the ultimate and permanent method of obtaining power as some engineers seem to believe. By reasons both of economy and convenience we are driven to the general adoption of a system of energy supply from central stations, and for such purposes the beauties of the mechanical generation of electricity can not be exaggerated. The advantages of this universally accepted method are certainly so great that the probability of replacing the engine dynamos by batteries is, in my opinion, a remote one, the more so as the high-pressure steam engine and gas engine give promise of a considerably more economical thermodynamic conversion. Even if we had this day such an economical coal battery, its introduction in central stations would by no means be assured, as its use would entail many inconveniences and drawbacks. Very likely the carbon could not be burned in its natural form as in a boiler, but would have to be specially prepared to secure uniformity in the current generation. There would be a great many cells needed to make up the electro-motive force usually required. The process of cleaning and renewal, the handling of nasty fluids and gases and the great space necessary for so many batteries would make it difficult, if not commercially unprofitable, to operate such a plant in a city or densely populated district. Again, if the station be erected in the outskirts, the conversion by rotating transformers or otherwise would be a serious and unavoidable drawback. Furthermore, the regulating appliances and other accessories which would have to be provided would probably make the plant fully as much, if not more, complicated than the present. We might, of course, place the batteries at or near the coal mine, and from there transmit the energy to distant points in the form of high-tension alternating currents obtained from rotating transformers, but even in this most favorable case the process would be a barbarous one, certainly more so than the present, as it would still involve the consumption of material, while at the same time it would restrict the engineer and mechanic in the exercise of their beautiful art. As to the energy supply in small isolated places as dwellings, I have placed my confidence in the development of a light storage battery, involving the use of chemicals manufactured by cheap water power, such as some carbide or oxygen-hydrogen cell.

But we shall not satisfy ourselves simply with improving steam and explosive engines or inventing new batteries; we have something much better to work for, a greater task to fulfill. We have to evolve means for obtaining energy from stores which are forever inexhaustible, to perfect methods which do not imply consumption and waste of any material whatever. Upon this great possibility, which I have long ago recognized, upon this great problem, the practical solution of which means so much for humanity, I have myself concentrated my efforts since a number of years, and a few happy ideas which came to me have inspired me to attempt the most difficult, and given me strength and courage in adversity. Nearly six years ago my confidence had become strong enough to prompt me to an expression of hope in the ultimate solution of this all-dominating problem. I have made progress since, and have passed the stage of mere conviction such as is derived from a diligent study of known facts, conclusions and calculations. I now feel sure that the realization of that idea is not far off. But precisely for this reason I feel impelled to point out here an important fact, which I hope will be remembered. Having examined for a long time the possibilities of the development I refer to, namely, that of the operation of engines on any point of the earth by the energy of the medium, I find that even under the theoretically best conditions such a method of obtaining power can not equal in economy, simplicity and many other features the present method, involving a conversion of the mechanical energy of running water into electrical energy and the transmission of the latter in the form of currents of very high tension to great distances. Provided, therefore, that we can avail ourselves of currents of sufficiently high tension, a waterfall affords us the most advantageous means of getting power from the sun sufficient for all our wants, and this recognition has impressed me strongly with the future importance of the water power, not so much because of its commercial value, though it may be very great, but chiefly because of its bearing upon our safety and welfare. I am glad to say that also in this latter direction my efforts have not been unsuccessful, for I have devised means which will allow us the use in power transmission of electro-motive forces much higher than those practicable with ordinary apparatus. In fact, progress in this field has given me fresh hope that I shall see the fulfillment of one of my fondest dreams; namely, the transmission of power from station to station without the employment of any connecting wire. Still, whatever method of transmission be ultimately adopted, nearness to the source of power will remain an important advantage.

Gentlemen, some of the ideas I have expressed may appear to many of you hardly realizable; nevertheless, they are the result of long-continued thought and work. You would judge them more justly if you would have devoted your life to them, as I have done. With ideas it is like with dizzy heights you climb: At first they cause you discomfort and you are anxious to get down, distrustful of your own powers; but soon the remoteness of the turmoil of life and the inspiring influence of the altitude calm your blood; your step gets firm and sure and you begin to look—for dizzier heights. I have attempted to speak to you on "Electricity," its development and influence, but I fear that I have done it much like a boy who tries to draw a likeness with a few straight lines. But I have endeavored to bring out one feature, to speak to you in one strain which I felt sure would find response in the hearts of all of you, the only one worthy of this occasion—the humanitarian. In the great enterprise at Niagara we see not only a bold engineering and commercial feat, but far more, a giant stride in the right direction as indicated both by exact science and philanthropy. Its success is a signal for the utilization of water powers all over the world, and its influence upon industrial development is incalculable. We must all rejoice in the great achievement and congratulate the intrepid pioneers who have joined their efforts and means to bring it about. It is a pleasure to learn of the friendly attitude of the citizens of Buffalo and of the encouragement given to the enterprise by the Canadian authorities. We shall hope that other cities, like Rochester on this side and Hamilton and Toronto in Canada, will soon follow Buffalo's lead. This fortunate city herself is to be congratulated. With resources now unequaled, with commercial facilities and advantages such as few cities in the world possess, and with the enthusiasm and progressive spirit of its citizens, it is sure to become one of the greatest industrial centers of the globe.

Editors Enjoy a Trolley Ride.

The Republican Editorial Association, of the State of New York, held its annual meeting in this city last week. They devoted the afternoon of Thursday to a trolley ride over Brooklyn in the beautiful parlor trolley cars which President Rossiter, of the Brooklyn Street Railway Company, provided for the occasion. Lunch was served in the cars and it was a very enjoyable as well as novel experience for the visiting editors to be whirled through the city of Brooklyn and suburbs while enjoying an excellent repast. After the ride they visited the Brooklyn Navy Yard, and were later entertained at a banquet at the Union League Club, of Brooklyn, through the courtesy of the president of the association, Hon. William Berri, proprietor of the Brooklyn *Standard Union*. The after-dinner speeches at the banquet were of unusual interest and were made by the following eminent gentlemen: Chauncey M. Depew, Elihu Root, Paul Dana, W. J. Arkell, George H. Daniels, Joseph Howard, Jr., Henry Watterson and Lieut. R. E. Peary, U. S. N.

Another Reason Why the Cable Should Go.

[*From the New York Evening Sun.*]

If you stand on a corner and wave your umbrella at a cable car, and it whirls past you without slowing down, don't blame the gripman until you have looked in the newspapers to see how many were injured. It was probably a runaway. The man in front may have been doing his best.

A Belt Manufacturer Assigns.

The assignment is reported of Edwin A. Burgess, a belt manufacturer in Providence, R. I., who did business under the name of A. Burgess & Son.

PERSONAL.

Mr. F. Laughlin, of the Solar Carbon and Manufacturing Company, Pittsburgh, came to New York city last week and made his headquarters at the Hotel Imperial.

Miss Bessie Orne and Mr. F. S. Burke, general manager of the Crown Woven Wire Brush Company, of Salem, Mass., were married at St. Peter's Church, Salem, on January 14.

Col. S. G. Booker, superintendent of the Phœnix Carbon Manufacturing Company, of St. Louis, spent the past week in New York and Boston. His many friends in these cities gave him a cordial welcome.

The West End Street Railway Company, of Boston, has retained Everett W. Burdett to act as legislative counsel at the State House this Winter. He is also counsel for the Boston Electric Light Company at the State House.

Mr. E. T. Copeland, the well known steam-power engineer and contractor, is the eastern representative of the Ball Engine Company, of Erie, Pa. Mr. Copeland's headquarters are at 39 Cortlandt street, New York.

Mr. E. Ward Wilkins, of the firm of Partrick & Carter Company, the well known Philadelphia manufacturers of electrical house goods and general supplies, has started on an extensive western trip, stopping at many of the principal cities between Chicago and San Francisco.

Mr. D. G. Scott, formerly with the American Electrical Works, is now representing in New York city the Crefeld Electrical Works, of Boston, manufacturers of magnet, office, annunciator, rubber-covered and weatherproof wires. Mr. Scott's offices are at 136 Liberty street, New York city.

Mr. C. H. Lease, son of Mrs. Mary Elizabeth Lease, the widely known lecturer, has purchased an interest in the Rousseau Electric Works, New York, and will enter actively into the electrical industry. The Rousseau company was established in 1870 and will no doubt be benefited by the addition of Mr. Lease to its staff.

A Busy Factory.

The Adams-Bagnall factory at Cleveland is one of the busiest establishments in the country to-day, both in the arc lamp and incandescent lamp departments. The improved arc lamp of this company is meeting with much favor wherever tried, and the increasing orders have filled every foot of factory space with workmen and moving machinery. The manager of this company, Mr. L. H. Rogers, is greatly pleased, as he has every reason to be, over the successful business with which his company has been greeted. Mr. Thomas C. Adams and Mr. E. J. Bagnall are both actively interested with the company, and the excellence of the product is largely due to their careful, skillful supervision.

ADVANCE INFORMATION

Electric Light and Power.

RALEIGH, N. C.—John C. Drewry is chairman of a company which has been formed for the purpose of erecting an electric light plant for the purpose of lighting the streets.

PETERSBURG, VA.—Address the Mayor concerning erection of electric light plant for street electric lighting, etc.

HEMPSTEAD, TEX.—Amsler Brothers can give information concerning the proposed electric light plant.

ROANOKE, VA.—The Mayor may be addressed for information concerning erection of electric light plant.

BRYAN, TEX.—City Clerk can give information concerning electric light plant.

FERNANDINA, FLA.—The Mayor may be addressed for information concerning proposed erection of electric light plant.

GAINESVILLE, GA.—The Gainesville & Chattahoochee Power and Manufacturing Company has been incorporated by C. C. Sanders, James W. Bailey, Z. T. Castleberry, George W. Walkers, for the purpose of developing and utilizing the water power of the Chattahoochee River in Hall County; also to erect electric power plant, with all necessary machinery for generating electricity by water or otherwise. Capital stock, $50,000.

SAVANNAH, GA.—Charles F. Graham has contracted with the Savannah Electric Light and Supply Company for an electric light plant.

NEW YORK, N. Y.—The Rex Incandescent Light Company has been incorporated by Morris Reno, James T. Cowdery and George H. Krotz, to manufacture incandescent light mantles and burners, etc. Capital stock, $300,000.

THORPE, WIS.—Henry Leiboie has been granted a 10-year franchise for an electric light plant.

NEW LONDON, OHIO—City Clerk may give information concerning contemplated erection of $8,000 electric light plant.

NEW BRIGHTON, PA.—The borough contemplates the erection of an electric light plant. The proposed new plant would be for 100 lamps of 1,200 candle-power, and it is estimated it could be built for $20,000.

DENVER, COLO.—The Colorado Electric Power Company has been incorporated by D. V. Donaldson, J. A. Hayes and George R. Buckman. Capital stock, $500,000. Principal office will be at Colorado Springs.

LITTLE ROCK, ARK.—An electric light plant will probably be installed in Gleason's Hotel.

HOMER, N. Y.—Steps are being taken looking to the establishment of an electric light plant to supply Homer and Cortlandt.

VINELAND, N. J.—City Council is considering two propositions for an electric light plant.

JOPLIN, MO.—A new electric light plant is to be established here.

DALLAS, TEX—The County Commissioners have decided to put in a dynamo and light the court-house at this place with electricity.

OTSEGO, MICH.—The new electric light plant will soon be in operation, a stock company having been organized to complete the plant.

EAST LIVERPOOL, OHIO — The East Palestine council have let the contract for the erection of a new electric light plant for the town to the General Electric Company, of Chicago, and the Buckeye Engine Company, of Salem.

VALLEY CITY, N. D.—The question of putting in an electric light plant at this place is being agitated. General Hughes is interested.

ROME, N. Y. — City Clerk of Mohawk may be addressed concerning erection of electric light plant.

TAUNTON, MASS.—City Clerk may be addressed concerning establishment of municipal electric light plant.

DAVISVILLE, N. H.—An electric light plant is to be constructed.

MALDEN, MASS. — Councilman Schumaker may be addressed concerning proposed erection of electric light plant.

ST. LOUIS, MO.—Robert E. McMath, president Board of Public Improvements, may be addressed concerning establishment of electric lighting plant.

RALEIGH, N. C.—John C. Drewry may be addressed concerning electric light plant. Correspondence is invited from builders of electric light plants.

CHICAGO, ILL.—Garfield Electric Light Company has been incorporated by W. H. Amerson, Louis A. Schaubel, M. Wengier, to construct and operate an electric light plant. Capital stock, $25,000.

New Telephone and Telegraph Companies.

TOPEKA, KAS.—A new telephone company is being organized by Kansas capitalists in opposition to the Bell company. It has over 250 contracts signed for 'phones in Topeka and will be known as the Mid-Continent. Among the Topeka men interested in the company are Lew Blackman, Herbert Hackney and W. H. Davis.

MONTPELIER, VT.—The People's Incorporated Telephone Company has been organized, with a capital stock of $150,000, and will commence operations at once in Washington, Windsor, Addison, Chittenden, Franklin, Lamoille, Orleans and Caledonia counties. Dr. Henry James is the president, Dr. E. G. Hooker, treasurer, and George H. Almon, general manager.

BELFAST, N. Y.—The Belfast Telephone Company has been incorporated to operate a telephone line from this place to New Hudson and Caneadea. Capital, $1,000, and directors, J. H. Chamberlain, N. C. Saunders, O. Gleason, of Belfast, and others.

PETERSBURG, VA.—A new telephone line is being constructed from this place via Ettricks to Mattoaca, a distance of about five miles.

NEVADA, MO.—This place, Fort Scott and Pittsburg, Kas., will soon be connected by telephone.

FORT WORTH, TEX.—The Southwestern Telegraph and Telephone Company is extending its line from Fort Worth to Hillsboro.

New Electric Railways.

ANDERSON, S. C. — Philadelphia capitalists have been granted charter for the construction of an electric railroad from Aiken, S. C., to Augusta, Ga.

SCITUATE, MASS. — A franchise giving the Scituate & Norwell Street Electric Railroad the right to build a line through the town has been granted.

LANSING, MICH. — The Benton Harbor Electric Railway and Transit Company has been incorporated, with a capital stock of $650,000.

ELYRIA, OHIO—A franchise has been granted to the Cleveland, Berea & Elyria Electric line to extend their line through the corporation. The line will be built to Oberlin, and will be finished by about July 1.

OLEAN, N. Y. — A trolley line from this place to Bolivar is to be constructed.

MANCHESTER, N. H. — A bill will be introduced into the legislature asking for a charter to build an electric railroad from this city to Goffstown, a distance of eight miles. The capital stock will be $150,000.

New Manufacturing Companies.

AUGUSTA, GA.—The Moore–Edenfield Electric and Manufacturing Company will apply for charter, with following officers: Geo. P. Weitch, treasurer, and R. J. Edenfield, general manager. The company will manufacture motors, dynamos and electrical supplies.

WATERVILLE, ME.—Bibber–White Company has been incorporated for the purpose of electric railway and electric light supplies, and electrical inventions and apparatus. Capital stock, $100,000. President, Charles A. White, of Malden, Mass.; treasurer, Charles E. Bibber, of Malden, Mass.

Business Troubles.

TOPEKA, KAS.—John Norton has been appointed receiver of the Brush Electric Light and Power Company.

RACINE, WIS.—The Belle City Street Railway Company, of which J. I. Case is president, has been placed in the hands of a receiver.

A Jersey Car-Shed Burned.

Fire broke out on January 19 in the Consolidated Traction Company's car-shed at Ocean and Gates avenues, Jersey City, N. J. There were 75 cars in the shed, but only one was totally destroyed. The fire is supposed to have been caused by an overheated car stove. The loss is estimated at from $7,000 to $8,000.

Important to Engine Builders, If True.

A dispatch to the New York *Herald* from Sleepy Eye, Minn., on January 16, is republished below:

The sale of Grant Bramble's rotary engine to the Allen syndicate, of London, Eng., has been consummated, and the Sleepy Eye inventor has letters of credit on the Bank of England for $6,700,000. The amounts paid were: For the English patent, $1,600,000; for France and Germany, $2,000,000; for the United States, $3,100,000.

These amounts, and the fact of the receipt of the letters of credit, were verified by the inventor to-day when I called on him.

Mr. Bramble is telegraph operator and station agent in Sleepy Eye, as the *Herald* printed on December 7, 1896, and was lately elected Alderman. In speaking of his invention to the *Herald*, he said:

"I first got the idea of a rotary engine from the turbine wheel. I could not see why steam could not do what water did, especially when steam had qualities that water lacked and they were essential. You know that when a little turbine is hit by a column of water no bigger than your pencil something has to go. It took many models and a great many failures to get the thing right. Finally, about five years ago, I hit the machine substantially as it is to-day.

"The Allen engineering syndicate, at the head of which is F. H. Allen, of the Allen Steamship Company, of Liverpool, has purchased the right for the machine for Europe and for the United States."

ELECTRICAL SPECIALTIES WANTED.

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"A. R.," —Care— ELECTRICAL REVIEW, Times Building, NEW YORK CITY.

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Kindred.... ...Interests

The Clonbrock Steam Boiler Company, of Brooklyn, N. Y., have just issued a very handsome catalogue, copy of which will be sent free on application.

The Missouri Telephone Manufacturing Company, of St. Louis, Mo., are just about completing extensive toll lines through the central portion of Tennessee, connecting all the different towns to Johnsonville and Britts Landing. It is one of the largest independent toll-line systems yet built in this country.

The Metropolitan Electric Company, of Chicago, has been given the general western agency for the Alcatrez electrical compound. This will interest all consumers of electrical compounds, as the Alcatrez has been proved more than satisfactory. It will not scale, crack nor burn, adheres tenaciously, and is proof against the action of the elements. The compound is made from the celebrated Alcatrez asphalt, and possesses many points of advantage.

The Dayton Globe Iron Works Company, of Dayton, Ohio, have prepared a very handsome calendar on which is mounted a photograph of the largest horizontal turbine ever built. It was supplied by this firm to the Boston & Montana Consolidated Copper and Silver Mining Company for its immense plant at Great Falls, Mont., and was recently illustrated and described in the ELECTRICAL REVIEW. The calendar is serviceable and quite a novelty in its design.

The Ball & Wood Company, steam engine builders, are moving their New York offices from Cortlandt street into the new Beard Building, 120 Liberty street, where their conveniences for transacting business will be very much improved. Their new rooms are five or six in number, and occupy the entire south end of the building, commanding not only plenty of light and air, but also a beautiful view of New York Harbor. This company have occupied their old quarters for some nine years, and, in moving to new ones, find themselves in good company, Henry R. Worthington, pump manufacturer, and other firms and corporations in similar lines of business being also tenants of the Beard Building. A cordial invitation is extended to all friends of the company to visit them in their new quarters.

The balance-sheet of the Union Railway Company, of New York city, as of December 31, 1896, is as follows:

Assets: Cost of road and equipment	$4,477,576
Materials and supplies on hand	25,923
Accrued taxes, insurance, etc.	17,501
Due by open accounts	61,041
Cash on hand	30,221
Miscellaneous	608
Total	$4,612,870
Liabilities: Capital stock, common	$2,000,000
Funded debt	2,000,000
Loans and bills payable	175,101
Interest on funded debt accrued	41,666
Due for wages and supplies	38,927
Due on open accounts	50,888
Profit and loss, surplus	306,335
Total	$4,612,870

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HENRY GEBHART.

January 15.

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January 16. T. P. GREGER.

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I inclose $4 (money order) to pay my subscription and to pay for "The Telephone Handbook." I can not at all afford to miss a copy of your paper. L. C. CATLITT.

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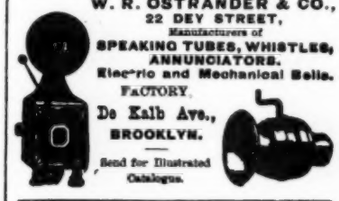

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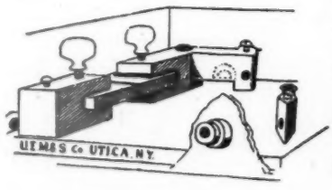

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Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED JANUARY 19, 1897.

575,322 Incandescent lamp socket; R. B. Benjamin, Chicago, Ill.

575,332 Electrically illuminated jugglery apparatus; M. Cronin, London—Transparent Indian clubs and means for illuminating the same, including battery cells in the same.

575,346 Electric railway; W. Grunow, Jr., Bridgeport, Ct.—An underground conduit for electric railways, comprising a metal trough having a flexible cover or top, composed of flexible metal plates, each of which is secured to the sides of the trough and to the depressible rail, said plates being curved inwardly at their adjacent edges, and securely bolted between strips of insulating material, between which is placed a depressible contact rail, on a level with the surface of the track, said conduit being also provided with a conductor situated in the bottom of the conduit and in proximity to said contact rail.

575,354 Electric rail bond; W. Jens, Johnstown, Pa.—A rail bond, having a portion of metal similar in nature to the metal of the bond-bar, integrally united to the rail and adapted to have the bond-bar attached thereto.

575,366 Electrical controller; W. H. Morgan, Alliance, Ohio—An open main frame, and an annular open frame within the main frame and an annular series of resistance coils spaced apart and supported on said annular open frame.

575,394 Magneto-telephone; S. D. Field, Stockton, Mass.

575,419 Telegraphy; P. B. Delany, South Orange, N. J.—A chemical telegraph system, in which signaling curren s of both polarites are transmitted, a receiver, comprising separate styluses for recording dots and dashes and the circuit in which they are located, and a polarized relay in shunt circuit therewith, and responding to the changes in polarity of the transmitted signaling impulses to serve as a telltale or indicator.

575,454 Series-multiple controller for electric motors; E. M. Bentley, Lawrence, N. Y.—Comprises a shunt for the two motors containing a resistance, an automatic circuit-breaker placed in the series circuit between the two inner terminals of the shunts and dependent on the volume of current passing therein.

575,479 Electric elevator or hoisting machine; R. M. Hunter, Philadelphia, Pa.

575,523 Push-button; C. O. Mailloux, New York, N. Y.—The combination with the contact mechanism in a push-button or a collection of push-buttons, a case inclosing the same, the circuit terminals of said mechanism located exteriorly to said case, and a removable face-plate covering said terminals.

575,615 Electric motor and device for conducting currents thereto; D. N. Osyor, Newark, Ohio—Consists of the positive and negative conductors of an insulating support, the brackets secured thereto for the conductors, respectively, and the reversible holders interposed between the conductors and the brackets and detachable from the conductors.

575,653 Electrical condenser; J. C. Lee, Brookline, Mass.—A condenser in the form of a flat rectangular solid, having rounded ends, and composed of alternate layers of a conductor and a non-conductor, wound together to constitute plates and dielectric of like contiguity throughout, the conductor layers being provided with suitable terminal attachments.

A Puzzle in Photometry.

[*From Progressive Age.*]

Suppose a cubical room measuring 10 feet in each direction to be lighted by a single central jet of a certain power. The illumination of the room under these conditions may be supposed to be standard. Now let one side wall of the room be replaced by a mirror. At first sight it would be said the room would be more brilliantly illuminated. But, looking in the mirror, one sees apparently a second room of 1,000 cubic feet volume lighted with standard brilliancy by a second standard jet. Question: (*a*) Will two standard jets illumine a room of 2,000 cubic feet more brilliantly than one such jet illumines a room of 1,000 cubic feet? (*b*) If not, is the original room lighted more brilliantly after the mirror is placed than before, or not? (*c*) If not, why not? Or if so, what is the mathematical relation between the two illuminations?

Advertising Pays.

[*From the Dublin World.*]

Angry Caller (at newspaper office)—Say, I want that little ad. I gave you two days ago—"Wanted, an electric battery, in good working order"—taken out.

Advertising Clerk—What is the matter? Didn't we put it in the right column?

Angry Caller—Column be dashed! The ad. overdid the business. My house was struck by lightning last night.

American Institute of Electrical Engineers.

The 111th meeting of the Institute was held at 12 West Thirty-first street, January 20, at which President Duncan presided. Seventy-five members and guests were present. The topic for the evening was "Electrically Driven Vehicles," the discussion being opened by Mr. A. L. Riker and participated in by Messrs. Duncan, Reckenzaun, Coho, Corson, Adams, Duryea, Sachs, Van Hoevenbergh and Pope.

PROPOSALS FOR ELECTRIC LIGHT PLANT AT HAWKINSVILLE, GEORGIA.

SEALED PROPOSALS will be received by the Mayor and City Council of Hawkinsville, Georgia, until 4 P. M., Wednesday, February 17, 1897, for erecting and installing complete an ELECTRIC LIGHT PLANT. The proposed plant embraces 40 1,200 c.-p.-arc and 750 16-c.-p. incandescent lamps.

Plans and specifications will be on file, and may be seen at the office of the Mayor, and copies of specifications, forms, etc., may be obtained from the Mayor after January 30, 1897.

The right is reserved to reject any, or all, bids.

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REFERENCES: "Electrical Review," New York; Paul Cromelin, Teller Lincoln National Bank, Washington, D. C.; Judge Geo. D. Parker, Berkley, Va.; Second National Bank, Washington, D. C.; E. K. Leech, U. S. Mint, Philadelphia, Pa.; W. F. Newell, Manager and Secretary Water Works Olympia, Oregon.

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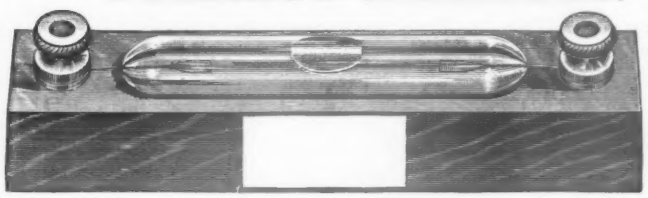

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